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**Analyzing the geometry of Iranian Islamic gardens  
based on the Quran's characteristics of paradise****Omid Rahaei\***Professor assistant (Phd in architecture) in Shahid Rajaei Teacher Training University,  
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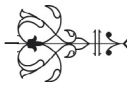
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**Abstract**

Iranian Islamic gardens like almost every cultures, represent beauty and happiness and improve the public perception. It has also special geometry with philosophical concept related to Islam's doctrine that is the focus of this research. Following Quran's contents, paradise is a beautiful sophisticated garden that something flows under its trees. So the comparison between the somatic geometry of Iranian Islamic gardens and the sophisticated conceptual heavenly descriptions of paradise in Quran is the matter of this research. Thus the configurations of the geometry, based on the paths of rivulets and airflow patterns in the gardens are considered here. The research method is interdisciplinary: in the first step, after initial considerations and exploring, the principals of Iranian Islamic garden's geometry were extracted by a comparative - descriptive method in some selected case studies. The construction of paradise in Quran frames the trajectory of analysis; so the next step is analyzing the paths and geometries with a consequential analytical method. Some simulations of the inner wind are presented also. The simulations include a validated computational fluid dynamics (CFD) model to illustrate the airflow current in this geometry. The results demonstrate the physical imagination of Quran's perception of paradise in Iranian Islamic gardens and the flows under the trees that is framed in a heavenly geometry.

**Keywords:** Iranian Islamic gardens, geometry, paradise, Quran, flows.



## INTRODUCTIONS

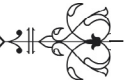
When the subject of Islamic gardens is discussed, the question which immediately arises is: "What effect does the Islamic religion have on these gardens? In Quran, the holy book of the Moslems, it is written that righteous people are promised paradise. So the features of this promised paradise as seen in the Quran and its commentaries which affect Islamic gardens should be identified. Before the birth of Islam, gardening were depended on the climate, and influenced by tradition, ritual, and cultural background of the people. In the Islamic age, the main objective in gardening was to make them as close to Quran's description as possible: a good garden was always compared with promised paradise. It should be noted that, viewed as a garden, paradise is merely an extreme example, much more desirable than what already exists. Iranian Islamic gardening was influenced not only by the descriptions of the promised paradise, but also indirectly by the Islam's imposed restrictions which affect the life of the people and their way of thinking; such as veiling, privacy, prohibited and non-prohibited relations, and so on. As it known, Iranian gardens which have come into existence since the Safavid Dynasty have been influenced by exotic methods, especially from Europe that evolve some of its features. Nevertheless there are some principals involved in geometry of Iranian Islamic gardens by moslem designers, that can confirm the inspiration of Quran's divine geometry. Thus the relation between celestial descriptions of paradise in Quran and the geometry of Iranian Islamic gardens (as well as its principals) is the matter of this research.

## LITERATURE REVIEW

Iranian garden is a cultural-historical phe-

nomenon usually established as an enclosed area in which plants, water and buildings are combined in a distinctive architectural system and create a favorable, secure and convenient environment for people (Talkhoncheh and Sichani 2014: 32-44). Garden in Moein dictionary is defined as Paradise that roots from two words "pairi" and "daz" (Islamic Encyclopedia 2002, 206). In Dekhoda dictionary, Pardis is rooted in Agglutinative Median language of Paradez that means garden (Dekhoda 1956). Nowadays this word in Greece (Paradisos) means garden and in French (paradise) means heaven (KING 1979). One of the most important characteristics of Iranian gardens is geometry. The most obvious feature of this geometry is the separation of the rectangle to four equal parts by two intersecting streams in the center connected to rectangle axis of symmetry. There in intersection usually exists a pond (Shahcheraghi 1383, 107-112). In Iranian gardens, water supply can be Qanat (underground water channel) or spring, flows under the trees through special paths (Behbahani 2006). It waters trees and flowers provide humidity in hot and dry climates (Masoodi 2008). Water fountains make the environment more beautiful (Penelope 2001). Trees provide shades (the most fundamental elements of the garden) and planting tall trees in both sides shows the path (Masoodi 2008). Verbal images and metaphors for Paradise had a great impact over the course of Islamic civilization (Blair and Bloom 1991). Because Quran inspired artists as a logical source and provided content with its messages to be expressed (Faruqi and Faruqi 1986). This conservatism led artists to attach religious meaning or symbolism to their works (Denny 1991). Forms, shapes, objects, scenes and even letters and numbers of Islamic art





are symbolic. All art has hidden significance (Faruqi 2002, 175). The design of the Persian gardens is based on the principles of symbolization (Kiani 2004). Ansary et al (2009) demonstrate that how Iranian gardens can be rehabilitated by using Islamic doctrine. Soltanzade, H. (2003) has a research about Iranian parks and their similarities to the Islamic Iranian gardens. The importance of water, trees and flowers in Islamic documents was investigated by Zamani (2009). He shows that the Persian garden has a wise, philosophical design concept and geometry (Zamani et al, 2009). In case of Bagh-e-Ferdos, Retrieving the original spatial structure and form was done, particularly in five categories, after an attempt to recognize the garden (Jeyhani and Mansouri 2012).

Mansouri, S. (2010) demonstrated the translation of sacred beliefs in Bagh-e-Fin. Hamzenejad (2014) investigated the Iranian Gardens' pattern, before and after Islamic period and compared them. He evaluated the changes after coming into Islamic period and considered the criteria of heavenly paradise in relation with Iranian gardens based on Islam's doctrines and Quran's verses (Hamzenejad et al, 2014, 57-79). The influence of ideas and ideals on Persian garden structures was considered in 2 case studies from Islamic period (Labibzade et al 2011). In all above studies the research method is a kind of descriptive. There are 2 methods for airflow analysis: experimental methods and digital simulations (Loomans and mook 1995). Rahaei (2014) presented an experimental method in a plant to investigate the indoor airflow tube (Rahaeib 2014). Furthermore ventilation analyses were considered and analyzed by Novoselac (Novoselac and Srebric 2002: 497-509), Rees (2001) and Ghali (Ghali et al 2007, 743-759)

using digital simulations. It is notable that in this research some simulations of wind flow under the Iranian gardens' trees and around their buildings is necessary to confirm the similarities between Quran's descriptions of Jannat (heavenly garden) and Iranian garden's geometry and the inspirations in design as well as the comparative descriptive analyses in true cases.

## METHODOLOGY

The purpose of this article is comparing the principals of the somatic geometry in Iranian Islamic gardens with characteristics of Quran's descriptive geometry of Jannat. It considers the effects of Quran's descriptions of Jannat on Iranian Islamic gardens also. Thus the geometry of Iranian Islamic gardens based on the Quranian phrase of "stream flows under the trees" (Jannat) is under discussion in this article. The word of "stream" in Quran's descriptions of Jannat (heavenly garden) is considerable in the terrestrial world from 2 aspects: in one aspect it is visible in the form of rivulets and the paths, and in another aspect it is invisible in the form of wind current. Since the study involves different fields and "many architectural researches require special combined techniques" (Groat and Vang 2004), this study is interdisciplinary. This paper reports an investigation of visible geometry of Iranian Islamic gardens and the invisible patterns of airflow under the trees, influenced by the Quranian phrase of Jannat. Thus in first step, some Iranian gardens as case studies were explored, and the principals of the geometry were extracted with a comparative-descriptive method. This step has been carried out through studying the related documents and researches, and observing some cases. Comparing the results with the Quran's notifications was another policy in this research. Thus





the initial data were gathered.

The next step was analyzing the geometry patterns under the trees with an analytical consequential method. To check out the air-flow pattern under the trees, a computational fluid dynamics (CFD) method was carried out. The results lead us to confirm the results. So this research will present the geometry of “streams flows under the trees” in Iranian Islamic gardens.

### IRANIAN GARDEN’S EVOLUTION

The archetype model of the Iranian gardening tradition is “Bagh”. The terms “bagh” and “Paradise” stand as a symbol of calm and happy life with full of spiritual blessings. The term “the garden of paradise” has a deep sentimental and religious impact on the literature and architecture. Plants such as platanus, cedar, the grapevine and pomegranate were symbolic and sometimes considered holy and life-giving. Supernatural powers were attributed because of the way people regarded plants. This high regard for plants led to the creation of symbols such as ‘the Tree of Life’. The Zoroastrian religion has two trees – the Tree of the Solar Eagle, which sprang from the primordial ocean and the Tree of All Seeds whose seeds are ‘the germs of all living things’. In Islam, at the foot of the Tree of Tuba or Sidra, in the centre of Paradise, four rivers are flowing: water, milk, honey and wine (Cooper, J.C., 1978: 178). According to these religious orders, gardens and gardening were sacred to the Iranians. Xenophon’s writings show the importance of trees and gardening to Achaemenid’s kings. Xenophon states: “...Cyrus, ... showed his paradise at Sardis: the beauty of the trees within, all planted at equal intervals, the long straight rows of waving branches, the perfect regularity, the rectangular symmetry of the whole, and the many

sweet scents which hung about them as they paced the park” (Xenophon, 2007). The oldest Persian gardens date back to the Achaemenid Empire and were found in Pasargadae (Fig. 1). The innovations of the main plan (four-part gardens) in Pasargadae were copied widely and with more complexity in all subsequent Persian and Islamic gardens (Ansari and Taghvaei 2008, 109). The reflection of the Pasargadae’s four-part gardens is clearly evident during the Sassanids Period (224-651 AD) and long thereafter, during the Seljukids (1038-1194 AD) Dynasty. Here the question is: what are the inspirations of Quran’s description of paradise in Iranian Islamic gardens’ design?

According four-part (Charbagh) concept, Moslems designed Islamic gardens as an image of Heaven in this world. In the Quran, Heaven is described as a place surrounded by eight principal gates with lofty gardens, shady valleys, fountains scented with camphor or ginger; rivers of water, milk, honey and wine; delicious thornless fruits in all seasons. Arabs by getting advantage of the above perception as well as the Pasargad garden’s plan patterns imitated the court of lions in Alhambra palace (Fig. 2). After Islam, ‘Heaven’ became an important concept that made a big change to the Persian garden (Ansari and Taghvaei 2008). Many heavenly features highlighted by the Quran were all used to make the Persian garden design successfully combine artificiality with naturalness (Table 1).



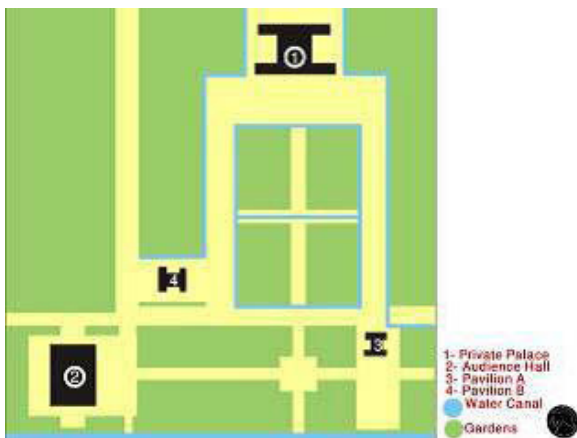


Fig. 1. the Great's palace garden at Pasargadae c550 BC. Water channels define the space between two palaces. (Ansari, M., and Taghvaei, A.A., 2008)

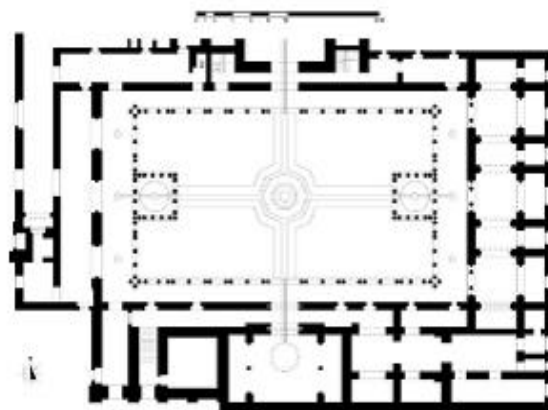


Fig. 2. Plan of the court of lions in Alhambra palace (Ansari, M., and Taghvaei, A.A., 2008)

In the fifteenth century, the Safavids established Shi'a (The second largest denomination of Islam) as the official religion of their empire. The Islamic concept of the Ideal City, formed according to the Garden of Eden, was taken into consideration in the Safavid period. Thus, the city was formed as an image of Heaven (Haghighat bin et al 2012, 80). The diagram in fig. 3 illustrates the formation and evolution of Iranian Islamic garden and its geometry.

## IRANIAN ISLAMIC GARDENS' CHARACTERISTICS

According to above, the Muslims derived and practically adopted the theme of garden/bagh from their Holy book. God Almighty repeat-

edly describes in the Holy Quran:

“Say: shall I tell you of what is better than these? For those who guard (against evil), there are gardens with their lord, beneath which rivers flow, to abide in them and pure mates and Allah's pleasure; and Allah sees the servants (Chap.3 “Family of Imran” Verse, 15).

“And hasten to (avail) forgiveness from your lord, and a garden, the extensiveness of which is (as) the heaven and the earth; it is prepared for those who guard (against evil)” (Chap.3 “Family of Imran” Verse, 133). “As for these/ their reward is forgiveness from their lord and gardens beneath which the rivers flow, to abide in them and excellent is the reward of the laborers” (Chap. 3 “Family of Imran” verse, 136).

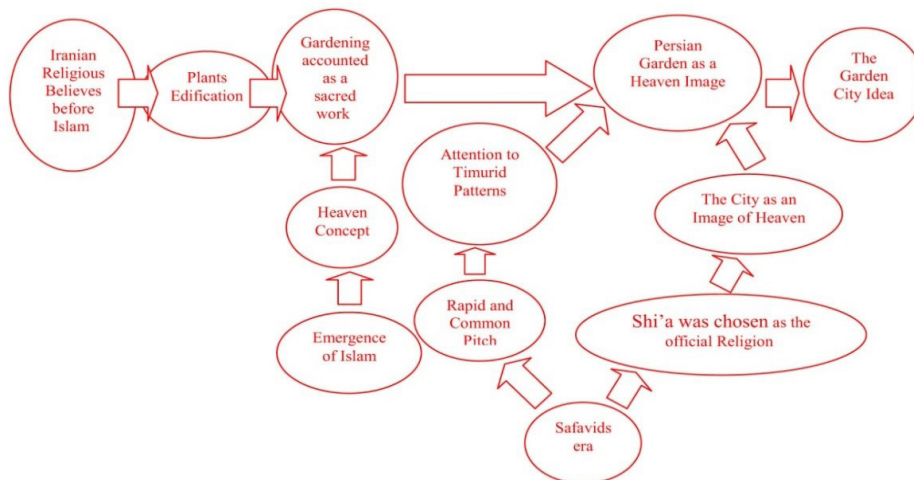


Fig. 3. Formation of Iranian Islamic garden in history (Haghighat bin, M. et al, 2012).



Table 1. Portrayal of heavenly features (according to Quran descriptions) in the Persian garden (Haghighat bin et al 2012, 80).

Portrayal of heavenly features in the Persian garden	Greenery and freshness	Climatic features allow designers to use both deciduous and evergreen trees. These varieties provide shade in the summer and sun in the winter. The differences between the trees available in the Persian garden mean that there is fruit in all seasons and greenery throughout the year (Refer to Sura-e-Ar-Room, Verses 15).
	Immortality	The principles of design and site selection used in the Persian garden follow the origins that caused these gardens to become immortal, the same as the Heaven (Refer to Sura-e-Taha, Verses 120).
	Heavenly pavilions	A pavilion in the Persian garden is symbolic of the heavenly pavilions (Refer to Sura-e-Al-Ankabut, Verses 58).
	Heavenly rivers, wells & waterfalls	Water that possibly emanated from the heavenly wells is drawn through the Persian garden along the canals with varying outer shapes. In addition, waterfalls are often used in various forms and settings. The sound of water is also important (Refer to Sura-e-Al-Waqiah, Verses 20-21 and Sura-e Mohammad, Verse 15).
	Enclosure	The Persian garden has always been enclosed by surrounding walls (Refer to Sura-e-Al Raad, Verses 23).
	Endless	The Persian garden is designed with features that cause them to seem endless or more extensive than they really are (Refer to Sura-e-Al Hadid, Verses 21).
	Naturalness	In the Persian garden designers tried to create some natural environments. Therefore, in some spaces they used plants in their natural forms and refrained from ornamental pruning (Refer to Sura-e-Al Baghareh, Verses 25).
	Centricity	The highest point created for the garden is a symbol for 'Ferdos' (the highest point of the Heaven, according to the Muslim prophet Mohammad). The pavilion is located at this point and usually water is divided from there (Refer to Sura-e-Al-Nur, Verses 35).

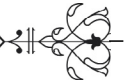
Besides, there are common certain features in all Iranian gardens which can be defined as follows: 1. A garden's laid out on steep ground, 2. The area of the garden is surrounded by a wall, 3. There is a main canal in it, 4. The area of the garden is divided into four, 5. There is a mansion or palace in the middle, 6. The planting of rose-bushes is frequent, 7. A close relation with nature is obtained in a simple manner and there is no interval or boundary line between the mansion and the rest of the garden, 8. A large number of trees are planted for the sake of shade, and as a result the garden contains narrow walks, 9. Canals are so designed that the flow of the water produces a sound, 10. The design of the garden is based on the use of straight lines, 11. Provision is made for the flow of the water to be visible, and grooves are cut in the bottom of the canals to cause the water to flow roughly as if it were flowing over rocks, 12. There are

a large number of fruit trees; the bigger the garden the more fruit-trees are planted (Daneshdost, Y., 2000).

The main thing that really distinguishes Iranian Islamic "Bagh" from other kinds of gardens is its special geometry. In Iranian "Baghs", there was a close attention toward geometrical forms especially square. Square has a symbolic role in philosophy of Islam. It hints to four rivers of paradise described in Quran (Pirnia, M.K., 1994). It is also a reminder of four holy elements: water, wind, soil and fire (Daneshdost, Y., 2000). The form of square shows the distance between garden elements also. Iranian ancient "Bagh" consists of square units (modules) called "carets". In each "caret" certain kinds of plants or trees were raised. Hence "carets" with regular rows of trees would be created. The first samples of this type could be seen in Pasargad royal "Bagh" (fig. 1). This form has a lengthwise







and a widthwise axis. This sort of geometry is the main feature of Iranian Gardening style especially after Islam.

In Iranian Gardening, especially after Islam, this method was elaborated and ornamented by moslem architects because the concept of square was corresponded to Quran's descriptions of paradise. Hence a new elaborated style in Iranian Islamic gardening was resurrected: there is always a main flow of water (a rivulet) in the main lengthwise axis of garden. The main building of the garden called "Koshk" is located at the intersection of the axis. In front of "Koshk", there is a long street located in the main view which ends to the entrance building of "Bagh" (Pirnia, M.K., 1994). The main axes divide Bagh

into four parts and this is the base of word "Char Bagh" (meaning four Gardens). "Char bagh" as one of the most important Iranian Islamic landscape styles is founded in different cities: "Kashan Finn Bagh", "Dolatabad bagh", "Shiraz Jahannama Bagh" and Etc. But depending on the place of "Koshk" (intersection place of lengthwise and widthwise axis) and the dimensions of the garden, they are different. Sometimes the Koshk is situated in the center of the garden (like Shiraz Jahannama "Bagh"), and sometimes it is situated in one side and the subsidiary buildings were around, so the main view was along the lengthwise axis of the garden (like Narenjestane Ghavam).

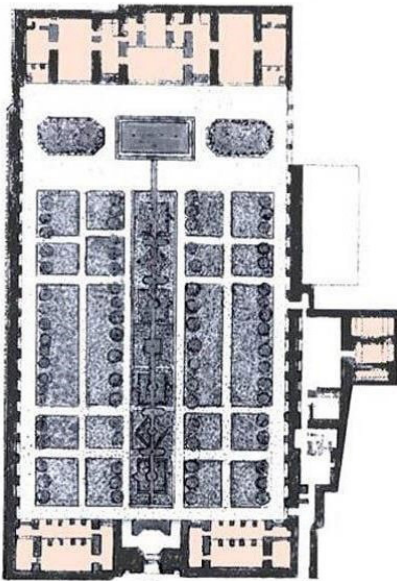


Fig. 4. Narenjestane Ghavam

In contemporary era, although copying western samples (like Saad Abad garden) some architects took efforts to combine western landscape design with Iranian Islamic gardening principles. Azadi square" in Tehran (1965) is an extraction of common squares in English style of landscape architecture. It is differ-



Fig. 5. Aerial view from "Azadi square"

ent to Iranian traditional gardening based on planting trees and creation of shades. Around the site no wall is seen and it is open. But, the geometry as the main principle in Iranian Islamic gardening is clearly observed in designing this square.





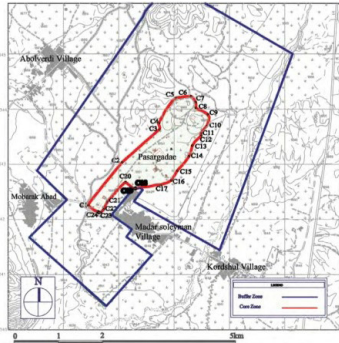
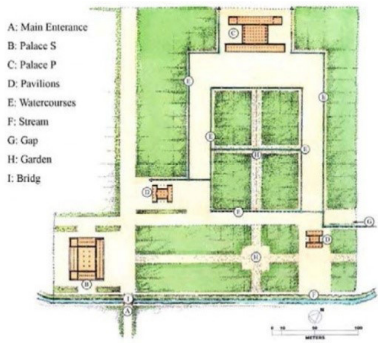
## COMPARING THE GEOMETRY IN SOME IRANIAN ISLAMIC GARDENS

In tables 2 and 3 there presented some Iranian gardens. Each one belongs to special age and all are famous. But in geometry, there are similarities that highlighted the Iranian style. Following the images in table 2 and 3, the geometry patterns were elaborated and the form of “Char-Bagh” was good developed and regularized as described in Quran which dominates its design. In Iranian Islamic paradise the streams of water flow beds on the main axis of the garden. There is perpetual shade over the pavements along the axis. So the extreme heat from the sun will be omitted. Following the tables 2 and 3 the geometry of all gardens has a lengthwise and a widthwise axis to form “Char bagh”. This axial separating pattern became the most important Persian landscape styles. Depending on the place of “Koshk” the intersection place of length-

wise and widthwise axis can be varied. In fig. 6 the variation of this intersection is illustrated from table 2 and 3.

Following the patterns of A, B, and C in fig. 6, some of the Koshks are placed in center of the garden and depending on the water streams, the geometry of Char bagh can be simple or complicated. The mentioned pattern is more similar to the gardens in table 2. But in some cases the form of Char bagh is more complicated and the Kooshk is not in the center of the garden. Following the patterns of A, B, and C in fig. 6, some gardens have more composition instead of symmetry. The symmetry in D and F is somehow complicated but all of the Iranian gardens have symmetry. These complicated models can be found in table 3. Bsghe-Dolat-Abad and Baghe-Pahlevan in table 3 have a complicated geometry: the position of the Kooshk is not in the central axe and probably the symmetry is not the aim of the designers. But the composition along with various perspectives is reached.

Table 2. some Iranian gardens: the map, site plan and geographical information

No.	Name of the Gardens	Province/ City	Geographical Coordinates	Site Plan: Zone boundary	map
1	Ancient garden of Pasargadae	Fars/Shiraz	N: 30° 10' 0.0" E: 53° 10' 0.0"		




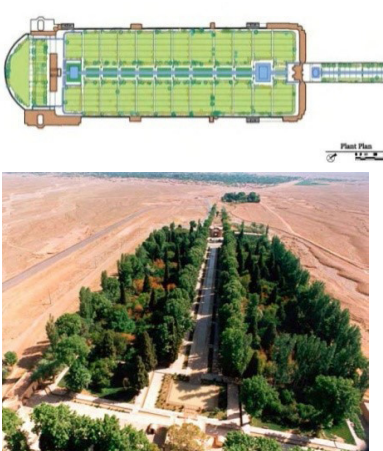
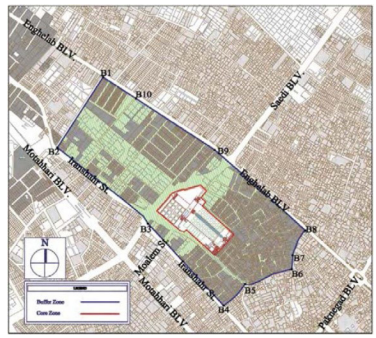
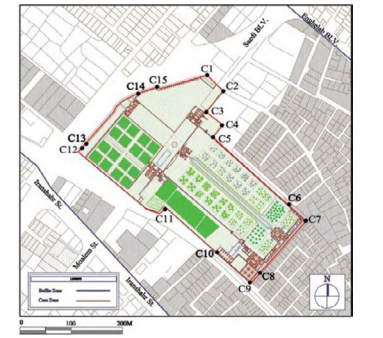
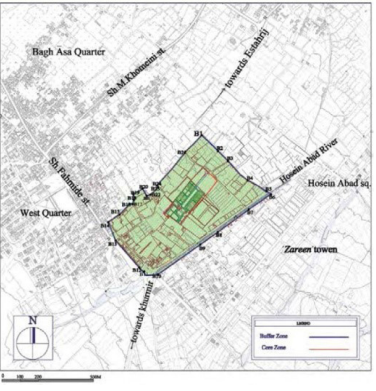
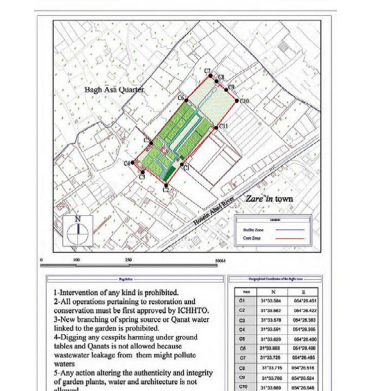


2	Bagh-e Eram	Fars/Shiraz	<p>N: 29° 38' 10.03'' E: 52° 31' 31''</p>		
3	Bagh-e Chehel Sotun	Isfahan/Isfahan Isfahan/Isfahan	<p>N: 32° 39' 27'' E: 51° 40' 20''</p>		
4	Bagh-e Fin	Isfahan/Isfahan	<p>N: 33° 22' 20.53'' E: 51° 22' 20.53''</p>		

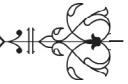




Table 3. some Iranian gardens: the map, site plan and geographical information

No.	Name of the Gardens	Province/ City	Geographical Coordinates	Site Plan: Zone boundary	map
5	Bagh-e Shahzadeh	Kerman/ Mahan	N: 30° 01' 30'' E: 57° 16' 59''		
9	Bagh-e Dolat Abad	Yazd/ Yazd	N: 31° 54' 12.30'' E: 54° 21' 6.59''		
7	Bagh-e Pahlavanpur	Yazd/ Mehriz	N: 31° 33' 36.6'' E: 54° 26' 25.21''		





8	Bagh-e Akbariyeh Birjand Southern Khorasan/ Birjand	N: 32° D1' 10'' E: 59° 13' 40''		
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Following the patterns of A, B, and C in fig. 6, some of the Koshks are placed in center of the garden and depending on the water streams, the geometry of Char bagh can be simple or complicated. The mentioned pattern is more similar to the gardens in table 2. But in some cases the form of Char bagh is more compli-

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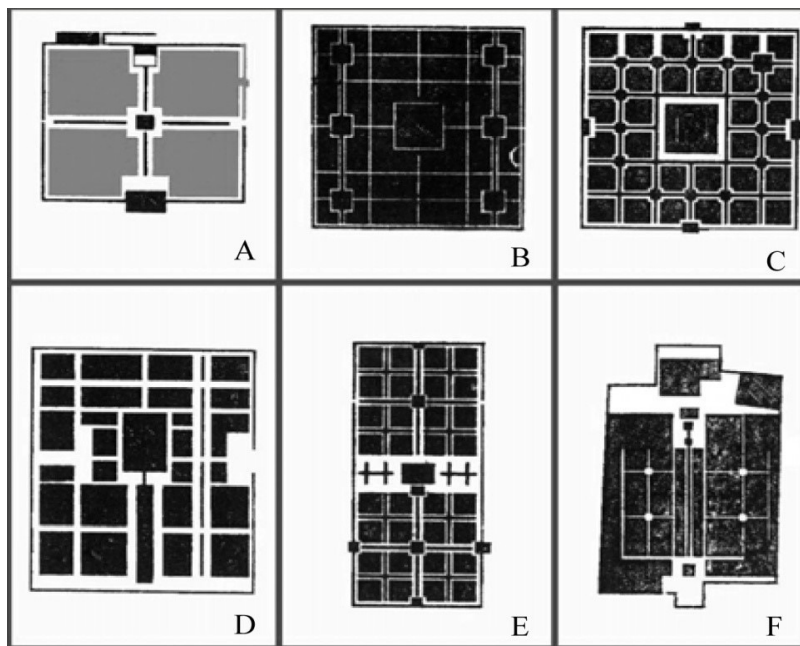


Fig. 6. Different geometry pattern of Iranian garden, based on the tables 2 and 3





## INSPIRATIONS OF QURAN

Following the Quran, the term “garden (in the form of Jannat)” was used 87 times to describe the paradise. The term “Jannat-ol-Ferdos” was used 2 times. Certainly there is wisdom and philosophy in it. The term “Jannat-on Tajri men-tahteha-al-anhar” means some gardens that flow the steams under their trees. This term was used in Quran many times to describe the paradise and following the Allame Tabatabaei’s exegesis, this is the best blessing that is never prosaic for a pious man. He said: “as we know the terrestrial pleasures are not the ultimate aim..., so in the doomsday, these mortal pleasures are for what...? This is a big matter... when the lord transferred the human from mortal world to immortal world, downfall and movement is taken from him” (Tabatabaei 2008). So as the god said, earthy living is the goods of afterlife or its merchandise (Al-e-Emran, verse 14). But the question is what the stream’s material that flows under the trees is. In many cases it is translated to water course, fountain, spring, and so on. Charbagh with its central pond is a kind of heavenly Quranian version that used in Iranian gardens. The heaven’s width is mentioned as wide as the all skies’ width and the earth’s width, even more than that (Al-Hadid, verse 21). In Soora Al-rahman (verses 46-75) it is mentioned that “there are 2 gardens with 2 springs with 2 different fruits... and either 2 other heaven...” It is notable that in Iranian Charbagh, there are 2 times twin gar-

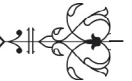
dens. So it can be said that Charbagh can be a kind of Quranian inspiration that watercourses divide it into 4 gardens. Following Quran’s notification, the different aspects of water in some samples is demonstrated in table 4.

Following table 4, the heavenly gardens are some places that some streams flows under its trees: main streams, secondary streams, watercourses, canals, partridgeous breast, fountains and so on are its elements. The streams can be visible or invisible. No one could say what the stream’s material is. However it has symmetry in heaven and probably has some rules to flow. Following Mohammad/15 (table 4) there are fourfold rivulets or following Al-rahman/ 46-75 there are 2 gardens with 2 springs. It could be said that Bagh-e-Fin is a kind of fourfold rivulet garden (table 2) and Bagh-e-Shahzade in Mahan is like the descriptions in Al-rahman. Fountains are the main parts of the heavenly springs (table 4). In Iranian Islamic gardens the water streams is lucid and originated from a gushing main spring (like heavenly springs in table 4). Following table 2 and 3, the main gushing fountain is in front of the Kooshk, originated from a Ghanat or spring from top side of the garden. The axial paths of water flows have some cascades and little waterfalls. A comparison between table 2, 3 and 4 can confirm the correspondence of the geometry in Iranian Islamic gardens and the heavenly descriptions of paradise in Quran.

Table 4. Spiritual aspects of water in Quran.

Iranian garden’s elements	Soora- Verse	Quranian expression	Descriptions/samples
Heavenly springs	41 times in Quran: in 37 times the term “eternal paradise with flowing rivulet” is used. Mohammad/15	Main streams, secondary streams, watercourses, canals, partridgeous breast, fountains. 4 stream to form the geometry of “Charbagh”; Iranian special style in gardening	جنان تجري من تحت الانهار Heavenly Four-fold rivulets





Heavenly water-falls	A'araf/ 160 Al-rahman/ 46 Ensan/ 18	Moses' miracle in making springs Gushing springs Salsabil's spring that has delicious wine of ginger	Qanat ceramic conduits fountains
Heavenly water-falls	Vaghe'e/ 30	ماء مكسوب	Cascade for little waterfalls
Heavenly ponds	Kosar/ 20	Kosar pond	pools in front of the Kooshks/ ponds
Heavenly rain for thirsty land	Enfal/11, Kahf/45, Forghan/48, Ankaboot/63, Loghman/10, Sajdeh/27, Fater/27, Zamar/21, Fosselat/39, Ghaf/9, Ghamar/11	ينزل عليكم من السماء ماء	Life of gardens in warm and dry climates, depended on the rain

In Quran the term of Garden is mentioned 87 times, that registered in table 5. Following the 2 tables (tables 4 and 5) the geometry of Quran can be extracted into the form of Charbagh (4 gardens) divide by rivulets (inspired by heavenly springs) that meets in the center of a pond (as mentioned in Quran: Kosar) in axial form. This geometry is very similar to Iranian Islamic gardens illustrated in table 2 and 3. Following table 5 the importance of gardens is recognizable. But the main point

of this table is the especial geometry of the streams under the trees of paradise described in Quran. Following table 5 the welfare condition is available in paradise for pious man. The under trees' streams, provide this happiness as mentioned in table 5. In Iranian Islamic gardens the designers tried to make such happiness with a cool wind flow in warm and dry climate of Iran. So some strategies were engaged.

Soora no.	Verse no.	description	Soora no.	Verse no.	description
7	19	U Adam! With your partner settle in that garden...	2	35	Adam! You and your wife settle in this garden...
18	32	Exemplify for them the 2 men that we gave to one of them 2 grape gardens and covered them with palms and...	34	16	...and we changed the 2 orchards of them to dry gardens with bitter fruits...
18	33	...between the 2 gardens we made a rivulet...	18	35	He... entered through the garden and said that...

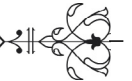




18	40	...hope that the lord give me a better thing than your garden...	68	24	...today no helpless people must come to your garden...
55	46	...for everyone who fears the god, there are 2 gardens...	55	54	...and handpicking the fruits from that 2 gardens are available...
39	74	...we'll settle into the garden...	55	62	...except that 2 gardens there are 2 gardens else...
4	13	...in gardens that flow streams under the trees...	5	12	...in gardens that flow streams under the trees...
13	4	...gardens of grapes that surrounded by palms...	3	15	...in gardens that flow streams under the trees...
10	9	...in gardens that flow streams under the trees...	2	25	...in gardens that flow streams under the trees...
9	21	...gardens with no limited blessings in heaven...	25	8	...no garden for him to eat fruits...
25	10	...in gardens that flow streams under the trees...	22	14	...in gardens that flow streams under the trees...
32	8	...gardens full of blessings...	22	19	...we made gardens with palms and grapes...
22	23	...in gardens that flow streams under the trees...	40	8	...immortal promised gardens...
34	15	...2 orchards for them in left and right...	32	19	...in immortal promised gardens will settle...
48	5	...in gardens that flow streams under the trees...	18	39	...when u entered in your garden, why...
47	12	...in gardens that flow streams under the trees...	50	9	...so we grew gardens and its seeds...
15	45	...no debt that the pious people are in paradise...	4	57	...in gardens that flow streams under the trees...
47	15	...in gardens that flow streams under the trees...	42	22	...heavenly gardens...
48	17	...in gardens that flow streams under the trees...	51	15	... the pious people are in paradise...
56	12	...in orchards with blessings...	44	25	...what gardens and what springs for pious men...
52	17	...gardens for pious men...	57	12	...in gardens that flow streams under the trees...
36	34	...in that land we made gardens of palm and grapes...	61	12	...in gardens that flow streams under the trees...
66	8	...in gardens that flow streams under the trees...	65	11	...in gardens that flow streams under the trees...
22	56	...and in that day they will be in paradise...	19	61	...the promised eternal gardens...







37	43	...gardens with blessings...	9	72	...in gardens that flow streams under the trees...
26	57	...orchards and springs...	71	12	...in gardens that flow streams under the trees...
68	17	...to handpick the fruits of the gardens...	27	60	...we sent water from sky and grew gardens...
38	50	...eternal gardens with open doors...	5	85	...in gardens that flow streams under the trees...
78	16	...complicated rampant gardens...	85	11	...in gardens that flow streams under the trees...
9	89	...in gardens that flow streams under the trees...	68	34	...orchards with full of blessings...
6	99	...gardens of grapes and...	70	35	...heavenly gardens...
98	8	...in gardens that flow streams under the trees...	17	91	...gardens of palm and grapes...
54	54	...pious men in gardens and rivulets...	9	100	...in gardens that flow streams under the trees...
78	32	...gardens and vineyards...	74	40	...among gardens they'll ask...
5	119	...in gardens that flow streams under the trees...	18	107	...paradise/ Ferdous- gardens...
6	141	...he is the one who make gardens with or without frameworks...	26	134	...gardens and springs...
26	147	...in gardens and springs...	3	195	...in gardens that flow streams under the trees...
3	198	...in gardens that flow streams under the trees...	2	265	...and who gave charity... is like gardens...
18	42	...what is done in his garden...	68	19	...something from your god descended to the garden...
68	20	...disaster garden in dry lands...	68	21	...gardeners call each other...
68	26	...as they see the garden...	55	50	...in that 2 gardens, 2 springs are flowed...
55	52	...in that 2 gardens there are 2 from each fruit...	55	56	...in that gardens there are virgin sirens...
55	66	...in that 2 gardens, 2 springs are flowed...			

### INVISIBLE STREAMS SAMPLE

The invisible streams in the form of airflow were recognizable in Iranian Islamic gardens. To confirm the results, the airflow under the trees of 2 famous cases (gardens of Fin in Kashan, and Shahzade in Mahan) were simulated. The simulations are performed in

Fluent (meshes with Gambit) and the results are illustrated (tables 6 and 7). Following the models there are always calm and suitable airflow in axial path that can increase the welfare conditions for peoples in the gardens. Following the Qurans descriptions of heaven (tables 4 and 5) it can be an invisible geome-



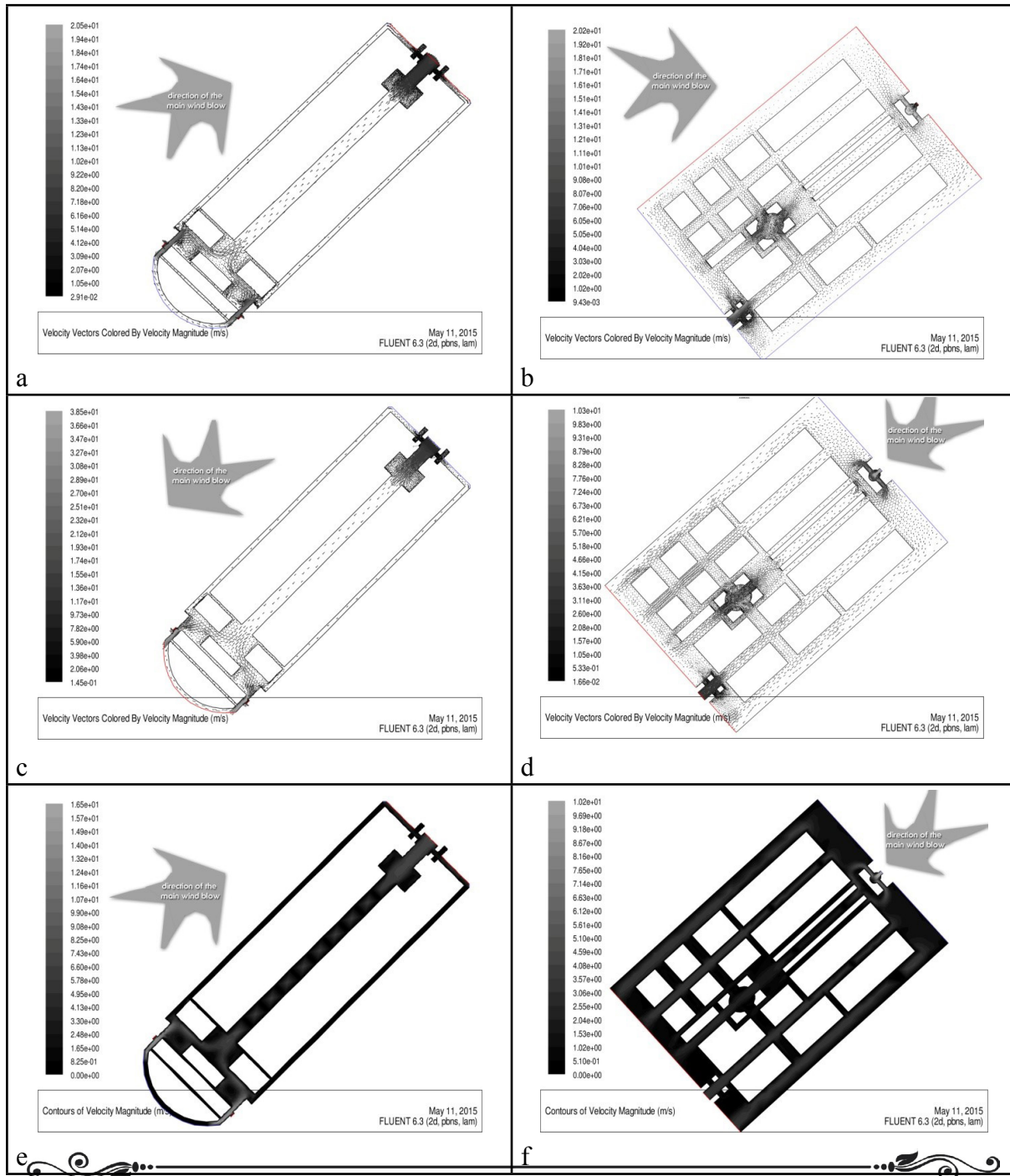


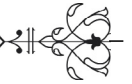
try that makes the Iranian gardens as similar as the promised paradise.

In simulations the direction of the main wind blow and annoying wind are considered. The openings were considered as velocity inlets and pressure outlets. So the simulations are

Table 6. The simulations of airflow in Fin Garden (b, d, and f) and Shahzade Garden (a, c, and e), using CFD method, based on the outdoor wind's speed. In all conditions there are cool airflows under the trees along the main axis.

presented. All the wind speeds data are extracted from the weather stations' sites of Kashan and Kerman. The simulations are presented in table 6.





## DISCUSSIONS

Following the Iranian gardens' geometry, illustrated in table 2 and 3, the water current in the form of rivulets flows along the steep of the site. The symmetry became a main principal in Iranian gardening especially after Islam. The main axis of the site was highlighted by rivulets. In the other word the rivulets' paths divided the gardens into 2 or 4 or more parts. Following table 4 and 5, this dividing method is similar to Quran's descriptions of Eden Garden, and was not coded in ancient Iranian gardens before Islam. The inspirations of "Pond of Kosar" in the center of paradise (table 4) were the bases of this type of gardening after Islam. Like what is described in Quran, the main pond (symbol of Kosar) was built in the main part of the Iranian Islamic gardens (in front of the Kooshk). It branches the water current into 2 or 4 or sometimes more canals that flow on the main axis along the steep field of garden toward the lower parts of the gardens.

Following Quran and Iranian styles of gardening, it could be said that the form of "Char-Bagh" is a kind of Islamic developed style in Iranian gardening that is rooted in ancient Persian "Baghs". Kooshks are situated in the top part of the Iranian Islamic gardens (sometimes in the middle and sometimes near one side) that the point of views is toward the lower parts of the garden. So both points of views and water streams are from upper parts to lower parts of the Iranian Islamic gardens along the main axis. This developed style was elaborated after Islam.

Nevertheless there is a notable considerable fact in Iranian Islamic gardens that is distinguished in this research's simulations: the directions of airflow under the trees as the invisible stream (another aspect of Quran's

description of streams under the trees). Following the table 6, in both samples the air current under the trees are along the main axis, but right in the opposite direction of water flow: the air current flows from lower part of the garden to the upper parts, along the main axis, right toward the Kooshk. A notable result is that the direction of the airflow currents and water currents are opposite of each other, but along the main axis of Iranian Islamic gardens. They overlapped each other also. With a consequential analytical method, it could be realized that there are correspondences between the geometry of Iranian Islamic gardens and the Quran's descriptions of heavenly paradise.

## CONCLUSION

Following Quran's descriptions, the man being is the representative of God on earth. He tried to create the symbol of the paradise since he lived on the earth. This article demonstrated that moslem perception of Paradise strongly influences the geometry of ancient Persian "Baghs" into Iranian Islamic styles of gardening. The image of paradise, which is described clearly in the Quran, is manifested in different branches of Muslims' art and architecture. Within the context of Islam, fruits, trees and greenery are included in the descriptions of Paradise.

The art of Iranian gardening derives from traditions, beliefs and culture of Persian people. Its theme had been derived from Islamic thought and ancient Iranian mythology. It is the symbol of the paradise, the eternal peace and blessing of God as mentioned in Quran. Caring about the geometry, full attention to axing, and designing main landscape in the lengthwise axis of the "Bagh" that is extracted from Iranian philosophy are the fixed items in Iranian Bagh design. In Iranian Bagh the phil-





osophical, religious, and symbolic elements are important. Influenced by Islam, there is always “something more” in these compositions of water, and plants than meet in the eye. Iran’s climate is mainly hot and dry with harsh storms, so all design methods were used to restrict the outdoor winds especially sand storms and to increase humidity. Iranian traditional architects used physical elements like water and trees. They involved a good geometry to create shade and so a suitable and desirable place with lower temperature and higher humidity in desert. The geometry restricts the outdoor winds and storms also.

Following the article, the geometry of Iranian gardens has some characteristics: the gardens placed on steep ground and surrounded by walls. It has a main watercourse and some axial secondary rivulets. The garden is divided into four main parts with a central Kooshk in the middle. There are many rose-bushes and a large number of trees are planted for shade and path. Watercourses are designed to make cascades. The form of Iranian gardens has a lengthwise and a widthwise axis, and this sort of geometry can be the main feature of Iranian style. The form of Charbaghs and Hasht-Beheshts are derived from this geometry.

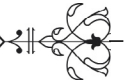
According to the article, the Iranian Muslims derived and practically adopted the theme of garden/ bagh from their Holy book: a symbol of promised paradise in Quran. This symbolic terrestrial paradise must be somehow a peaceful and blessed place with a calm and pleasant climate. Square has a symbolic role in philosophy and Islamic Culture and in composition with cross, points to four rivers of paradise and Kosar Pond described in Quran. The form of square shows the distance between garden elements obviously. In Iranian Islamic Gardening, in the main lengthwise axis of garden,

there is always a rivulet: the main flow of the water and following the simulations there is always a calm stream of airflow in opposite direction of the water flow: water flows from upper parts to lower parts of the garden and air current flows in a reversed direction, from lower parts to upper parts. However both streams are axial. At the intersection of the axis the main building of the garden called “Koshk” is located. Following the Quran’s descriptions, all of the principals that make an imagination of paradise, is used in Iranian Islamic gardens. According to table 5, times and times the term of “...in gardens that flow streams under the trees...” is used. The terms of “...2 gardens and 2 springs...” or “...2 gardens in 2 orchards...” and “heavenly garden” and “Ferdous” and “...except that 2 gardens there are 2 gardens else...” and so on, is used too many times. These terms have emphasis on the Iranian Islamic gardens’ geometry.

According to simulations in tables 6, there is always a calm and pleasant stream under the trees of Iranian Islamic gardens that is invisible and in the opposite direction of the water flow. So the streams under the trees of Iranian Islamic gardens are accommodated on Quran’s descriptions of paradise. Finally it can be said that the geometry of Iranian Islamic gardens are along with the Quran’s description and derived from its verses. It has some especial characteristics mentioned below:

1. The term of “...streams under the trees” from 2 main aspects are considered in Iranian Islamic gardens: water flow (visible), and airflow (invisible) that following the article, it is the base of Iranian Islamic geometry of gardens.
2. The streams under the trees are axial along the main axis of the gardens.
3. The form of cross applied in the configura-





tion of the Char-Baghs and its dividing axis, reminds us the imagination of Kosar-Pond and the 4 rivers of paradise.

4. In contrast to Iranian ancient gardening the geometry of Iranian Islamic gardens established based on the invisible streams of the air under its trees to establish the pleasant airflows in all points of the garden, and fol-

lowing the simulations the water flows were organized based on the axial good airflow. Thus the configurations of the geometry of Iranian Islamic gardens were established based on the invisible and visible streams physically existed under the trees, as mentioned in Quran

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