

Specification of Tiling Builder

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1. Purpose

The purpose of Tiling Builder is to build aperiodic and periodic tilings by using four basic tiles, namely hexagon, crown, star, decagon, which are the various combination of the regular pentagons. The pentagonal motif is derived from the structure of the Al-Mn decagonal quasicrystal [1-4] and related crystalline phase, e.g. Al₃Mn, Al-Mn-Ni and Al-Mn-Zn phases. The software can be used to interpret the structures of decagonal quasicrystal, various domain and crystalline phases.

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2. Graphic user interface

The GUI of Tiling Builder consists of display panel and a drop-down menu. Figure 1. shows the GUI of Tiling Builder and dialogs for tile size, tile type and tile appearance frequencies.

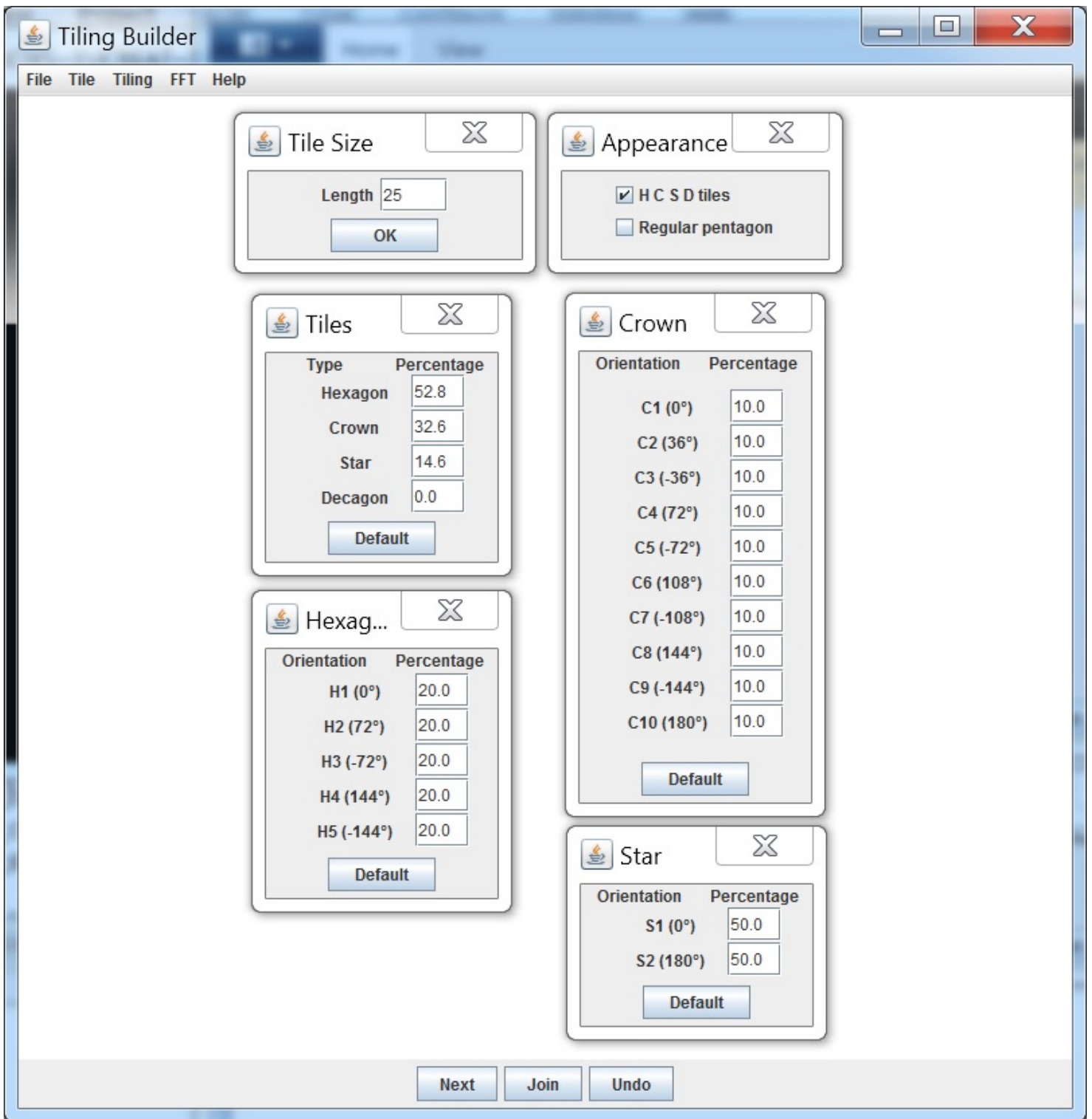


Figure 1. The GUI of Tiling Builder and the dialogs for tile size, tile type and tile appearance frequencies.

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3. Features

Tiling Builder are easy to use to build aperiodic and periodic tiling using HCSD tiles or regular pentagon, and to obtain the FFT spectrums of the tilings. The tiling can be built by the HCSD tiles and their orientation with pre-defined frequencies or by any tile and orientation as needed. Tiling Builder can be used for make a fully filled tiling or a tiling with void or other defects. The tiling data can be saved and reloaded, therefore a complex tiling can be completed in a multiple times. The tiling and fft spectrum can saved in JPEG image.

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4. Installation

Java virtual machine (J2RE) must be installed for running Tiling Builder. You may download J2RE from Java official website.

The executable bytecodes and the specification file (this file) is available in compressed form (tbuilder.7z) at <http://www.unl.edu/ncmn-cfem/xzli/programs.htm>

Uncompress tbuilder.rar into a user defined directory, e.g. c:\tbuilder\ and execute tbuilder.jar (double click the icon in window or type java -jar tbuilder.jar in command line).

The software works in two levels, demo level and full level. A license file is required for running in the full level. Without the license file, the software can be run in the demo level. The software is fully operational at demo level, but the tiling is limited to a number of tiles.

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5. Basic operation

To start the software, double click the icon of tbuilder.jar in window or type java -jar tbuilder.jar in command line.

5.1 Define the tile frequency in percentage

Press Tile-> Percentage: four dialogs will appear. Default values were derived from two-colour Penrose tiling (Li *et al.* 1994), thus for the construction of aperiodic tiling for decagonal quasicrystal. The values can be pre-defined for various domain structures of periodic tilings. By click on the hexagon (crown, star, decagon), a 100.0 % certainty can be set up, and then the orientation can be set up in the similar way, therefore a needed tile be picked up.

5.2 Build up tiling

Click Next in the bottom of the panel, a tile will appearance according to its frequency percentages of the type and the orientation.

Move the mouse pointer to the tile and press Left-Mouse-Button to move the tile to a suitable place in the panel, where it can be attached the existed tiling.

Click Join in the bottom of the panel, the tile attach the existed tiling. If the tile should not be in this place, Undo in the bottom of the panel will remove the tile from the existed tiling. Continue to next tile until the whole tiling is built up.

Press Tiling-> Appearance: select the appearance of HCSD tile or Regular pentagon, then the tiling of HCSD tile or regular pentagon or both is obtained. Figure 2. shows the random packing of H C S tiles and a new tile is about to attach the existed tiling.

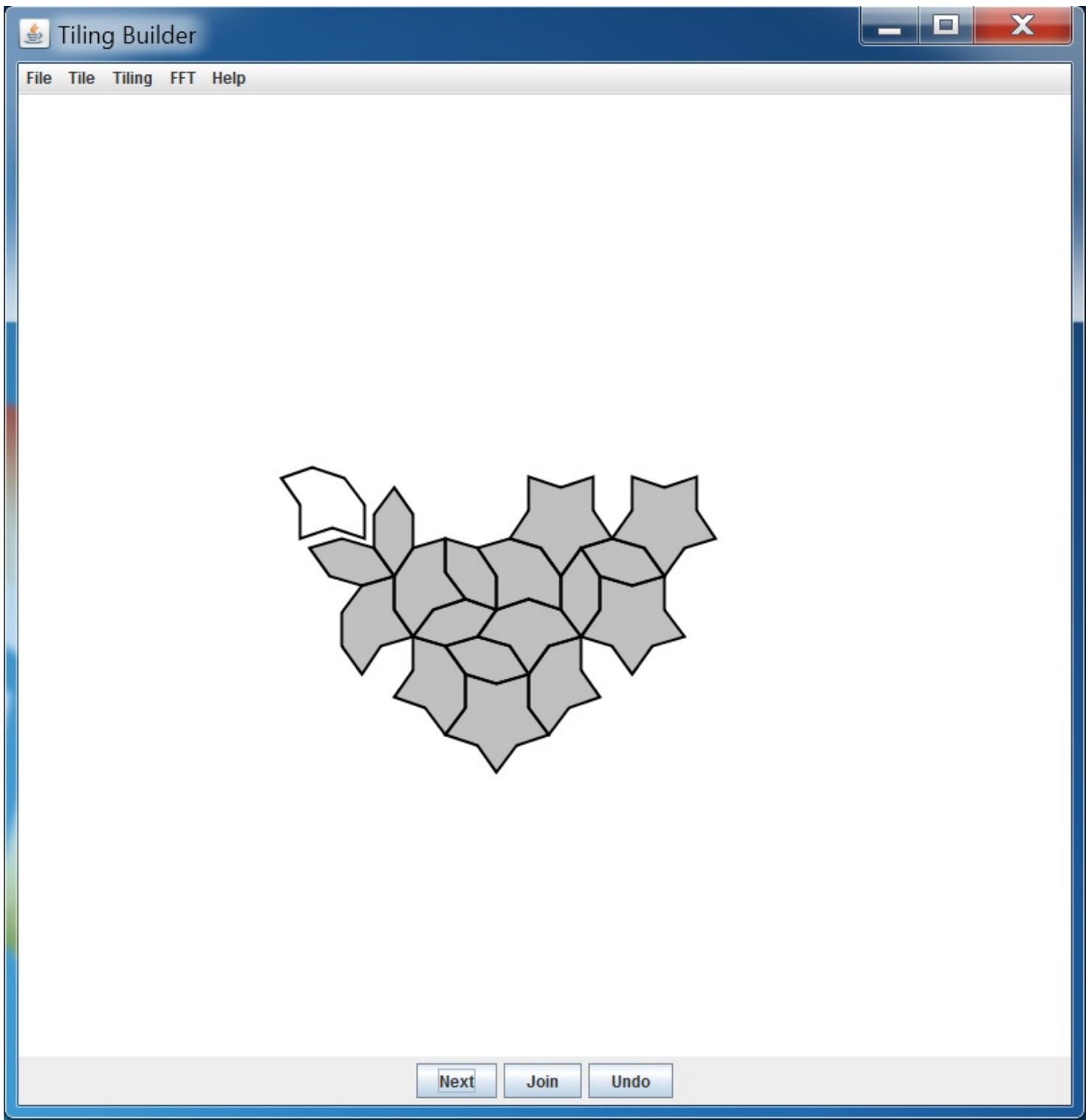


Figure 2. The random packing of H C S tiles.

5.3 Make FFT

Press FFT-> Area: select a start point in the panel and press Left-Mouse-Button and drag the mouse to select an area for the FFT. Figure 3. shows (a) a collection of vertices in the selected tiling in regular pentagon is obtained in direct space, and (b) a FFT pattern of the selected tiling is obtained in reciprocal space.

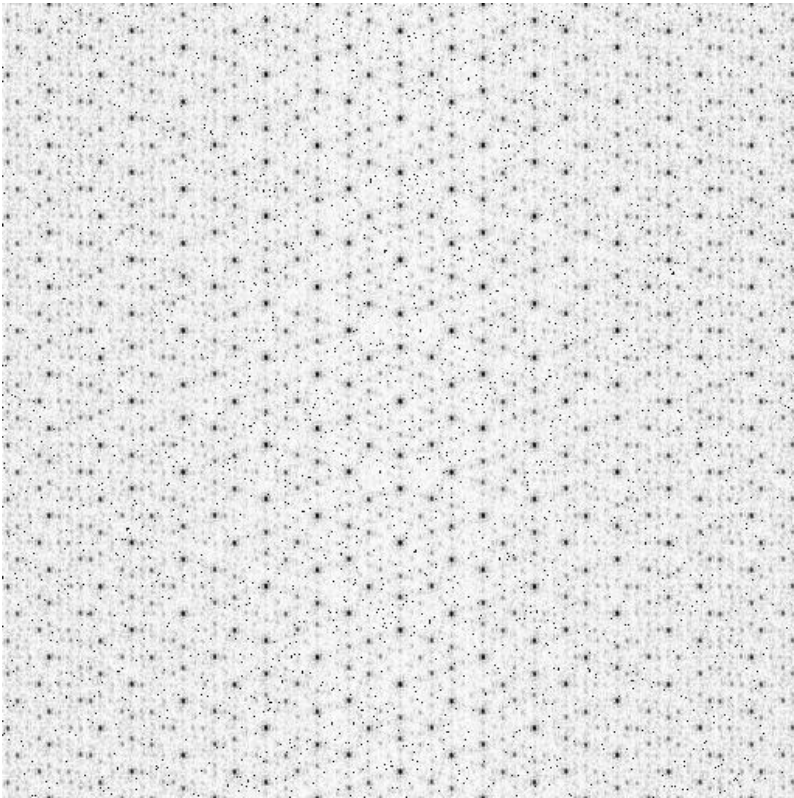
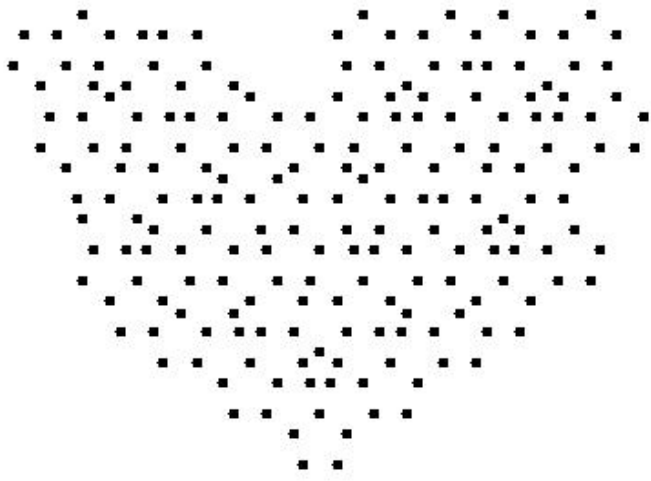


Figure 3. (a) a collection of vertices in the selected tiling in regular pentagon is obtained in direct space, and (b) a FFT pattern of the selected tiling is obtained in reciprocal space.

5.4 File and image

The created tiling can be saved to a binary file by File-> Save and can be reloaded later by File-> Load, so to continue working on the tiling. The tiling and FFT pattern can be save to an image in jpeg format.

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6. Contact info

For the license, please write to jlandyne@gmail.com or xzli@unl.edu. Suggestion and bug reports are welcome.

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7. References

<http://landyne.ueuo.com>

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