Problem Statement
The Inductive Rotation (IR) method, developed by the artist Hofstetter Kurt, creates two-dimensional, aperiodic patterns by applying recursive transformations to the copies of a single prototile. The aim of this thesis is to parallelize the existing pattern generation algorithms via GPGPU methods, to investigate the properties of a newly developed tile substitution algorithm for pattern generation and to improve the artist’s design process by providing an extended tool-set like a graphical prototile editor.

Algorithms
The thesis contributes a new algorithm for generating Inductive Rotation patterns, the parallel approach. The algorithm assigns an index to each tile and then uses an idea known from numeral system conversion, which is again based on Horner’s method, to map the index of a tile to a chain of transformation matrices. This chain of matrices is then used to determine the exact position of each tile within the pattern. These mappings are then executed in parallel via GPGPU methods.

The thesis also implements an algorithm based on work of Frettlöh and Hofstetter [FH15], the substitution tiling approach. The algorithm uses four different rules to replace each tile in each iteration, similar to simple L-Systems. This approach generates a tiling that contains a 3-way IR pattern.

Results
The parallel approach allows the artist to generate patterns that are about 12 times larger compared to previously existing approaches. The approach also increases the generation speed for large patterns. The extended toolset, especially the integrated prototile editor, has proven useful to Hofstetter and will aid him in future artistic experiments.