

The use of L-System for Modeling Purkinje Fibers

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Purkinje fibers are located in the ventricular walls of the heart, just beneath the endocardium and conduct electrical stimulus from the right and left bundles to ventricular myocardial. Recently, anatomists (Shimada et al.) revealed that Purkinje fibers construct a mesh structure. In this poster, we present a method for modeling the mesh structure of Purkinje fibers by applying L-System.

L-System is a formal grammar which defines a growth of a fractal structure by generating rules (or rewriting rules) and an initial structure. L-System was originally formulated for describing the growth of plant's cell, and applied for various purposes in computer graphics field, such as modeling of plants, buildings, streets, or ornaments. We modify the growth process of L-System as follows Each growing branch keeps away from existing branches as much as possible so as to construct a uniform distribution, and when collisions of branches occur, we connect the collided branches so as to construct a closed mesh structure. We design a generating rule based on an observation of anatomical photograph of Purkinje fibers, and manually specify three terminal positions of the right bundle branch, the left anterior fascicle, and the left posterior fascicle on a three dimensional heart model. We then grow fibers starting from each of the three positions based on the specified generating rule.

Using the modified L-System, we achieved to create three dimensional Purkinje fiber models which have a similar structural characteristic to the real photograph.