Manufacture-oriented Struts Structure Optimization of Flow Diverter for Intracranial Aneurysm

Mingzi Zhang
Jan. 24, 2014

Abstract

The purpose of the work is to carry out automatic stent structure optimization after which the structure of the stent was able to be made out and tested for its feasibilities. The work was tried with an idealistic 3D geometry of aneurysm(sphere, D=8mm, neck plane R=2mm) with parent artery(tube, D=4mm, L=60mm). The D3Q9 topology of LB model was applied and the spatial discretization was chosen as 1/20 mm, which gave the aneurysm neck an 80*80 lattices plane. The neck plane was divided as 16 sub-domains, each with 20*20 lattices. One of the sub-domains was chosen as the mask, based on which the structure optimization performed. During generating, the mask was supposed to duplicate itself to the whole neck plane according to the given algorithm. The main concept of strut generation was to make sure that all struts connected to ensure the manufacture possibility. The generating method was concerned: Given an initial strut structure, randomly select one lattice that could be removed, then move it to a randomly selected position. The methods could maintain the stent porosity by controlling the struts number inside a certain area. The CFD was supposed to perform after every 5 steps shift.