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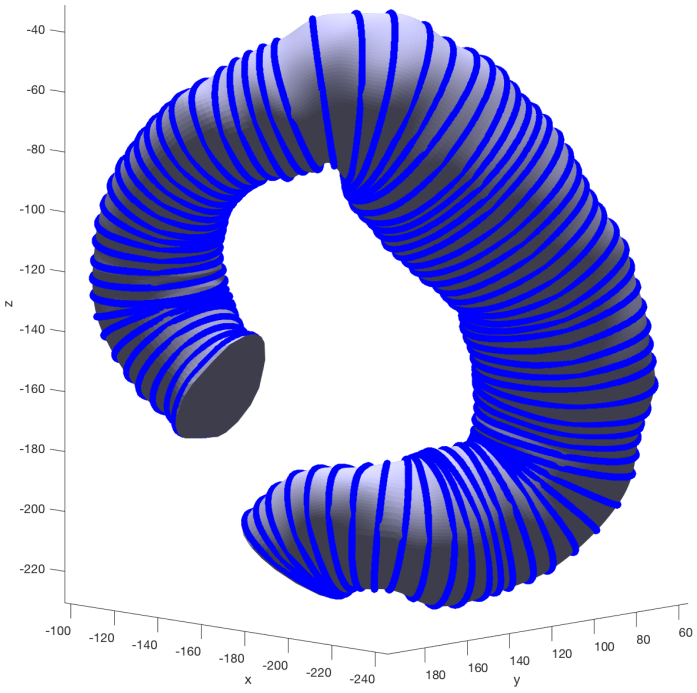

Definition of Tubular Anatomic Structures from Arbitrary Stereo Lithographic Surface Input

Surface Definition Suitable for Lagrangian Description in Cylindrical Coordinate system

Master's thesis in Mathematical Science

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Department of Mathematical Sciences
CHALMERS UNIVERSITY OF TECHNOLOGY
Gothenburg, Sweden 2017

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Cover: Triangulated stereo lithographic surface of thoracic aorta with cross sectional contours for vessel description

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Abstract

As a step to be able to reduce tedious, manual and user intensive surface definition, a new method for defining tubular anatomic structures from arbitrary surface input has been developed. The method has been validated for coherence to existing method for definition of surfaces used for vessel description in Lagrangian cylindrical coordinate system.

The new method for describing vessel geometry was successfully developed. The possibility of having arbitrary triangulated stereo lithographic surface input, automated center line definition, safety against intersecting cross sectional contours and automatic clean up of geometries are the main advantages against existing method.

Validation has shown that the developed method is suitable for segmentation of arbitrary 3D surface input and coheres well with existing method for certain applications. Further work includes improving the method and interface and making it more intuitive and fast, as well as utilizing the method for a comparative statistical analysis of a larger set of patient thoracic aortas, pre- and post surgery. The method forms an important part in better understanding the vascular system in both geometrical and anatomical ways with respect to identifying abnormalities linked to disease and how stents and surgery is affecting the native vessels.

Keywords: Vascular System, stereo lithographic, 2D-segmentation, Surface curvature, center line curvature, TEVAR, aorta, Lagrangian cylindrical coordinate system

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Johan Bondesson, Gothenburg, September 2017

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