

Open Thesis: Extending Superquadric Streamtubes for Indefinite Symmetric Second-Order Tensor Fields

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In 2014 Wiens et al. [7] developed a method called superquadric streamtubes which they utilized to display uncertainty in diffusion tensor fields. Their motivation was based around Magnetic Resonance Imaging (MRI) data and their application for medical research and patient evaluation. In summary they developed two approaches utilizing the superquadric shape space designed for diffusion tensors [3]. Their first method consists of the description of the superquadric streamtubes as it is the base for the second one. The second approach builds also on the glyph for **H**ilbert Space Embedding of **F**iber **V**ariability **E**stimates (HiFiVE) [6] and focusses on encoding uncertainty into the visualization. The latter method is a crucial problem of tractography for **H**igh **A**ngular **R**esolution **D**iffusion **I**maging (HARDI). In their final remarks they stated, that this method can be extended to the indefinite symmetric second-order tensor case by using the updated superquadric shape space presented by Schultz and Kindlmann [5].

For this thesis the extension should be implemented and evaluated based on stress tensor fields of mechanical component datasets. Furthermore a comparison analysis to other line-based methods like hyperstreamlines [1] and tensor spines [4] should be given. As a final remark there should be a discussion about further extending this approach to general second-order tensors including the asymmetric second-order case since there are glyph solutions, too [2].

The thesis can be written in German or English language. Since the implementation part should be done with FAnToM¹ knowledge of object orientated programming (C++) and scripting (Python) is an advantage. As the topic is related to tensor visualization the lecture "Wissenschaftliche Visualisierung" (Scientific Visualization) should be well known. Successful theses are invited to submit a paper to an international visualization conference.

Due to copyright issues please visit Figure 1 of [7] for a picture of superquadric streamtubes and Figure 5 b) and c) of [5] for pictures related to the superquadric shape space and coloring.

References

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¹<http://www.informatik.uni-leipzig.de/fantom/>

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