THE UNIVERSITY OF CHICAGO

COMPUTATIONAL AND APPLIED MATHEMATICS STUDENT SEMINAR

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B-Spline Curve and Surface Algorithms Using Open CASCADE

THURSDAY, May 23, 2019, at 1:00 PM

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ABSTRACT

Often, airplane models are provided by Computer-Aided Design (CAD) files in e.g. the STEP or IGES format which allow the digital exchange of information among CAD systems. Being well-suited for this purpose, the disadvantage is that these files are inefficient to work with when using stand-alone software for aerodynamic and hydrodynamic simulations with the surfaces defined by them.

During my two years working for the German Aerospace Center (DLR) as a student, my task was interpolating the discrete points representing airplane parts and full airplane models specified in STEP files usually provided by Airbus by B-spline curves and surfaces. The open-source library Open CASCADE was used here to work with B-spline curve and surface objects in C++ and Python. It turned out that the theory of so-called Gordon surfaces of William J. Gordon was especially fruitful because of creating very well-formed (in the aerodynamic sense) and smooth surfaces. Having these points interpolating surfaces at hand, the next step was discretizing them again but now in the input format for the 3D panel method NEWPAN. The results after running the aerodynamic simulation of NEWPAN give insight of how big pressure oscillations are throughout the airplane surface.

In this talk, I'm going to walk you through the steps of creating interpolating B-spline surfaces (especially skinned surfaces and Gordon surfaces), discuss some issues which come up discretizing them again for NEWPAN, give a quick overview of the functions I've implemented, and show you the resulting surfaces representing the current FLEXOP demonstrator aircraft of the EU Research and Innovation program Horizon 2020.

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