

Internship: A New Analytical Contact Method for Madymo

February-November 2022

Internship stipend: €450/month (the Hague)

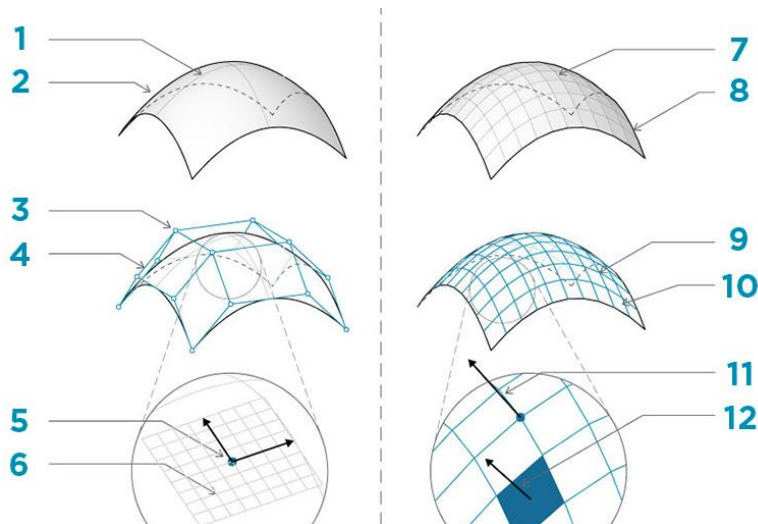
Simcenter Madymo is the industry leading software for analyzing human safety. It is a multiphysics solver with multibody at its core, allowing for rapid, robust simulation of complex scenarios.

A key aspect of dynamic analysis of this type is modelling the interactions between bodies whose surfaces come into contact with each other. Madymo allows two different types of surface definition: simple 3-dimensional mathematical shapes, or finite element (FE) surface definitions of nodes and elements. When using rigid FE surfaces, also known as facet surfaces, much of the speed of multibody analysis can be maintained while still allowing complex shapes to be defined.

In recent years, much work has been done on isogeometric analysis (IGA), which allows the analysis of CAD-type structures defined by non-uniform rational basis splines (NURBS). Among other benefits, this offers an even more accurate description of geometry.

Siemens is interested in investigating the possibility of using an IGA-type approach to solve contact using rigid NURBS-based surfaces, and would like an intern with strong analytical skills and familiarity with numerical modelling to develop a prototype demonstrator.

This internship is situated in the Madymo solver development group based in The Hague, Netherlands.



Scope

The aim of this internship is to develop a prototype to demonstrate the possibility of modelling rigid contact surfaces defined with NURBS, using IGA theory. Existing contact algorithms will be used in order to compare the demonstrator with the currently available implementations in Madymo.

The model will be validated against a combination of simple analytical contact simulations and load cases that the existing code finds challenging to solve.

Objectives

- Develop an understanding of multibody contact analysis, including current limitations
- Gain familiarity with constructing NURBS analytical surfaces
- Interface regularly with colleagues to understand practical coding and modelling considerations
- Develop a novel prototype to demonstrate a NURBS-based contact implementation
- Define a validation set to demonstrate the viability of the prototype
- Carry out validation of the technique against the validation set

Requirements

The prototype must integrate with the current design philosophy of Madymo, associating a surface with a rigid body and using the existing contact approach where applicable.

The validation set must demonstrate the validity of the method under normal Madymo use case parameters.

Deliverables

1. Literature Review/Goals Report
2. Interim Report for internal review
3. Final Report
4. Final Presentation
5. Prototype with user documentation and validation set

Involved Parties

TU Delft, Delft, The Netherlands

Siemens Industry Software Netherlands bv, The Hague, The Netherlands

Approval to Proceed

The undersigned have reviewed, approved and authorized the internship project to proceed

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