# Dynamics of nonlinear isogeometric catanery models

**Z. Lozina*, D. Sedlar† and I. Tomac†**

* Faculty of Electrical Engineering, Mechanical Engineering and Naval Architecture (FESB)
University of Split
21000 Split, Croatia
e-mail: zeljan.lozina@fesb.hr, web page: http://www.fesb.hr

† Faculty of Electrical Engineering, Mechanical Engineering and Naval Architecture (FESB)
University of Split
21000 Split, Croatia
Email: damir.sedlar@fesb.hr, ivan.tomac@fesb.hr

## ABSTRACT

The geometrically nonlinear dynamic model of the catanery is discretized relaying on isogeometric analysis (IGA) principals, [1,2]. The total and update Lagrangian formulations are implemented, [3].

The catanery dynamics is a topic that attracts attention due to wide range of applications rose in mooring system, transmission lines, civil engineering, ... The objective of the research is to develop robust and effective modelling tool which can be easily combined with isogeometric and other (e.g. FEM) engineering tools.

Generally, the implemented procedure has two steps: a) a search for initial configuration under initial loads and b) dynamic analysis. The first step is nonlinear static analysis referred to as form finding and the second step referred to as dynamic analysis can be dynamic characterisation of the system or search for the transient response of the nonlinear dynamic system to the force load or kinematic excitation. All aspects of the analysis have been performed for the catanery discretised on IGA principles. The dynamic characterisation involves eigen-analysis for the model linearized around equilibrium position. The transient response over the waste range of large displacements and rotations has been calculated using step by step methods.

The practical applications of catanery systems typically involve large displacements and large rotations but small deformations and therefore in the focus of the research were such models, however the large deformation model are proved to improve convergence rate and accuracy without the significant increase of the numerical effort, as demonstrated.

Many problems assume prestressed catanery. The prestress can be enforced in three independent ways: a) additively directly to the stress of the integral of the nonlinear stiffness matrix, b) kinematicaly extending the catanery to the new initial length and c) gradually increasing external load to the required prestress. All options are implemented and comparatively analysed.

A number of numerical tests have been performed on the benchmark examples and compared with finite element method solutions and with other authors, [4], wherever applicable. The comparative analysis involves the refinement strategies in both: IGA and FEM.

## REFERENCES

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