Isogeometric Analysis with Scaled Boundary Parametrizations for Twin Screw Compressors

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ABSTRACT

Twin screw compressors are machines consisting of a complex geometry with two rotors and a casing. During their operation thermo-mechanical stress is generated and results in a deformation of the geometry, which might impair the functioning. To simulate such a phenomenon numerically, particular emphasis should be placed on an accurate description of the boundary surfaces. Isogeometric Analysis (IGA) allows the exact geometry to be incorporated into the simulation, however, a versatile method of generating volumetric parametrizations is still to be developed. Here we present a special class of the so-called Scaled Boundary Parametrizations, which are particularly suitable for the rotatory geometry and can be easily generated from the B-spline or NURBS representation of its boundary. We compare such parametrizations with conventional bivariate parametrizations using the Poisson equation as example. We then proceed to a coupled time-dependent thermo-mechanical simulation, which exploits the matching IGA description of the boundaries between different geometries involved to achieve an exact data transfer. The implementation is based on the open source C++ library G+Smo.

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Keywords: Isogeometric analysis; Scaled boundary parametrizations; Thermo-mechanical coupling.

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