On the Compactness of Artificial Compressibility Approximations of Weak Solutions for Fluid Problems in a General Moving Geometry

Anna Hundertmark, Stephan Schmitz

RPTU University Kaiserslautern-Landau, Germany
A.HUNDERTMARK@RPTU.DE

Abstract

In this talk a, fluid flow problem on a time dependent deforming domain for a Newtonian fluid in two and three space dimensions with artificial compressibility approximation is studied. The equi-continuity in time estimate of the weak solutions under suitable domain regularity assumptions is proven, which serves as an alternative compactness argument for approximate weak solution sequences with respect to artificial compressibility, bypassing the application of the Lions-Aubin Lemma and its generalizations for solenoidal solutions on moving domains.

The corresponding estimate, which is uniform with respect to compressibility parameter is obtained by remapping the problem onto a fixed reference domain and using appropriate divergence-free test functions involving the difference of two solutions at different points in time, thus on different domains. The solenoidal property of the test functions is guaranteed by an appropriate divergence-preserving transformation between the two domains. The presented result is a generalization of compactness arguments used in author's previous works on fluid-structure interaction in special 2D domains, see e.g., [1].

References

[1] A. Hundertmark-Zaušková, On the convergence of fixed point iterations for the moving geometry in a fluid-structure interaction problem, J. Differ. Equ. 267(12) (2019), 7002-7046.