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Numerical Investigation of Oleo-Pneumatic Shock Absorber: A Multi-fidelity Approach

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The internal flow dynamics of Oleo-pneumatic shock absorbers remains a challenging area of ongoing research. The multiphysics nature of the problem makes it difficult to identify the dominant features of the flow field and the conditions under which important phenomena, such as cavitation, are likely to become significant in a given design. Hence, it is desired to develop a framework that allows the performance of shock absorbers to be explored in a systematic manner.

A representative shock absorber geometry is developed based on the general guidelines available in the literature [1], and it is validated against the drop test experimental measurements of Milwitzky and Cook [2]. Simulations are conducted using a multi-fidelity approach ranging from unsteady scale resolving three-dimensional simulations to dynamic system models, in addition to steady and unsteady RANS simulations.

High fidelity simulations provide a detailed insight into the flow physics inside the shock absorber, as well as help calibrate and validate lower fidelity methods, under conditions for which no experimental measurements are available to achieve that purpose. While lower fidelity methods are used to efficiently scan the design space and test the dependency of the shock absorber performance on the various design parameters, in addition to identifying parameter combinations that would be of interest to investigate using a high-fidelity simulation.

REFERENCES

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