Maha Fluid Power RESEARCH CENTER

PURDUE UNIVERSITY

- WEBINAR SERIES -

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Cavitation Modeling Using Lumped Parameter Considering Bubble Dynamics

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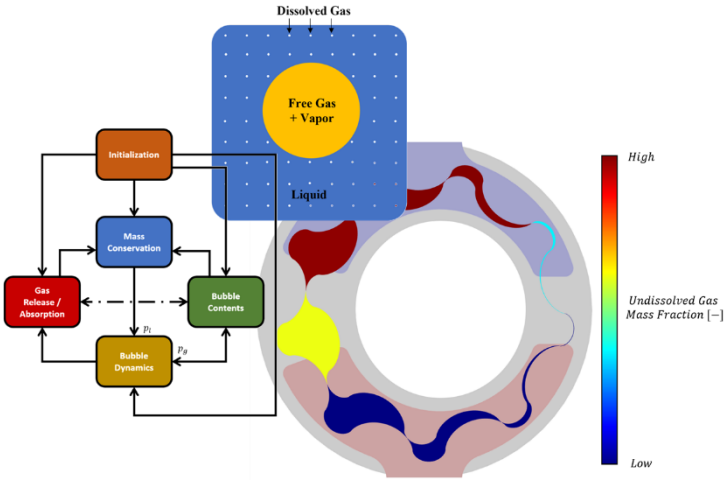
Abstract

Vaporous and gaseous cavitation cause several physical phenomena which are typically undesirable, such as increase in fluid compressibility and material damage. Therefore, the ability to capture these effects in simulation is highly valued. In the fluid power field, lumped parameter modeling technique has proven effective for analyzing components and systems, allowing for fast simulations. Past efforts in modeling cavitation using lumped parameter approach have assumed dependence of fluid properties such as bulk modulus, density, and viscosity directly to pressure and temperature. This cannot be considered as the fluid mixture is composed of different phases of matter. Some other formulations account for gaseous cavitation based on the equations that are derived from vaporous cavitation. This webinar illustrates a better approach that combines the two cavitation effects by considering that both vapor and undissolved gas co-occupy a spherical bubble. The size of the spherical bubble is solved using the Rayleigh-Plesset equation, and the transfer of gas through the bubble interface is solved using Henry's Law and diffusion of the dis-solved gas in the liquid. These equations are coupled with a novel pressure derivative equation. To show the validity of the proposed approach, the instantaneous pressure of a closed fluid volume undergoing expansion/compression is compared with multiple experimental sources, showing an improvement in accuracy when compared to existing models. Integrating this modeling technique with current displacement chamber simulation can further improve the understanding of cavitation in hydraulic systems. To illustrate this, a reference positive displacement unit will be used to highlight key advantages this system of equations offers over common alternatives.



Join this webinar to learn more about these topics and gain insight into the cavitation modeling in use at Maha.

(*) *The webcast link will be shared to Maha members, as well as to companies interested in joining the Maha center.*

For more information on the webcast, and for receiving the webcast link, please contact avacca@purdue.edu, or shangl@purdue.edu, or Prithvi at pchandir@purdue.edu