**Numerical simulation of cavitation-induced liquid jet impact on human skin: Needle-free injection**

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**Abstract**

Numerical simulations using an explicit density-based solver (ForestFV [1]) to capture the cavitation induced liquid jet impact on human skin are presented under various initial states to investigate the effects of the bubble growth on jet velocities and jet penetration into the human skin. To accurately resolve the different flow structures, that exhibit vastly spatial and temporal differences, such as the expanding cavitating bubble, pressure waves, the jet interface, and the skin deformation a Diffused Interface Model (DIM) with Fluid-Solid Interaction (FSI) was employed, based on the work of Saurel [2] coupled with Adaptive Mesh Refinement (AMR) for general unstructured 3D domains. The resulting liquid jet velocities are in good agreement with the experimental work of Schoppink​ [3]​, for various initial conditions providing a relation of initial bubble pressure to jet velocities, paving the way for more accurate numerical simulations. Furthermore, skin penetration is investigated for various liquid jet velocities, providing an insight to stress development and skin deformation characteristics. Different skin types were also examined, providing thus a further understanding of the cavitation induced jet penetration in biological tissue.

# Bibliography

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