Abstract Submitted
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Adjoint-based shape optimisation of inkjet printhead with compliant boundaries[1] PETR KUNGURTSEV, MATTHEW JUNIPER, University of Cambridge — A drop-on-demand inkjet printhead is a narrow, ink-filled, channel with a piezoelement on the upper boundary and a nozzle on the opposite side. A high-frequency electric pulse is applied to deform the piezoelement, pushing a small amount of fluid through the nozzle to create a droplet. After the pulse ends, acoustic waves continue to propagate inside the channel. The printing speed depends on the rate at which droplets are expelled and therefore on the frequency of the applied pulse. As the pulse frequency increases and approaches the first natural mode, the amplitude of the acoustic wave increases rapidly. This leads to an unpredictable oscillatory behaviour inside the channel as the acoustic waves have not decayed before the start of the next pulse, and the print quality reduces. We demonstrate how to adjust the printhead geometry to increase the decay rate of acoustic oscillations, which should maintain print quality for higher frequencies. We have derived the decay rate sensitivity to the shape changes in Hadamard form, and modified the channels geometry to increase the decay rate of acoustic fluctuations. Also, the presence of the domain boundaries compliance is taken into account to consider their deformation under the influence of the oscillations propagating inside.

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Matthew Juniper
University of Cambridge

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