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Topology optmized structures exploiting internal contact

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A third medium contact model to topology optimization has been developed by Bluhm et al. [1]. The novel approach exploits the properties of a compliant nonlinear material model in the void region of the design domain. This nonlinear material becomes increasingly stiff when compressed, thus enabling it to transfer forces when ultimately compressed. Promising results have been presented by Bluhm et al. [1], thus providing an opportunity for further structures and mechanisms to be developed using this approach.

Here, the third medium contact model to topology optimization is utilized in the generation of optimized structures exploiting internal contact towards achieving a design objective. The presented structures and the approaches used to obtain them may be used in various mechanical systems ranging from soft robotics and household appliances to biomechanics and structures incorporating inherent safety.

Results show promising properties of structures exploiting internal contact obtained through the third medium contact model to topology optimization. This includes the generation of features creating internal self support upon deformation as well as the opposite; features reducing internal self support upon deformation. These results may be very useful in the design of compliant mechanisms since the addition of contact enlarges the solution space, and thus provides an opportunity for obtaining even better designs.

REFERENCES

[1] Bluhm, G.L., Sigmund, O. and Poulios, K. Internal contact modeling for finite strain topology optimization. *Comput. Mech.* (2021) **67**: 1099-1114.