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# MODEL ORDER REDUCTION FOR PHYSICALLY-BASED AUGMENTED REALITY

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Real-time simulations of physical problems have become a very useful tool in tasks such as prototyping, design, system optimization, parameter estimation of dynamic models, or even education. Many times, solving physical problems in a parametric way is still a rather costly task. Today's demands require immediate results, and we are not always willing to wait for a computer to finish the computation in order to get the simulation. That is why we employ dimensionality reduction methods to reduce the computational effort, but always preserving reliable results. Of course, this has a previous computational cost, in the form of an initial analysis of the solution, but in return we can evaluate the solution in real time, understanding real time as frequency rates so fast to be imperceptible to humans (e.g. 30 Hz if we work with video sequences).

Over the last decades a great development has been carried out in model order reduction methods [1], achieving great results. But perhaps now we should be able to adapt these tools to the new techniques of visualization and representation of data, such as images. In this work we propose the union of model reduction with real-time data acquisition (image frames). A video sequence is an extremely high flow of information, and its use to feedback physical simulations supposes the opening of a new field to apply the computational methods.

We have merged computational mechanics, model order reduction and computer vision techniques to create video sequences where real information captured by the camera and virtual information from our simulations are mixed, what is called *Augmented Reality*. But we are adding virtual information solving the real mechanics of the deformable solid, which means extremely precise visual results, as if virtual objects were (really) real.

## REFERENCES

[1] D. González, A. Ammar, F. Chinesta, and E. Cueto, *Recent advances on the use of separated representations.* International Journal for Numerical Methods in Engineering, 81.5 (2010): 637-659.