Simulation of reversed torsion of the AlMg6 aluminium bar using the macro-molecule approach

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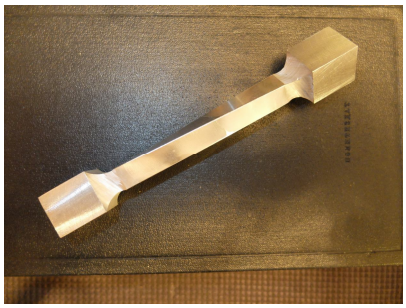
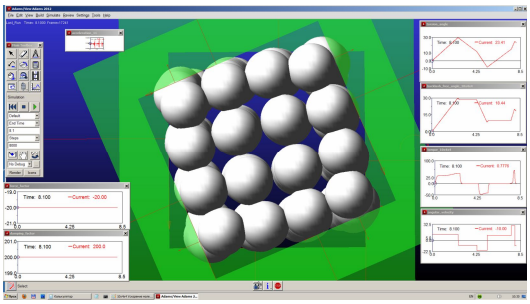
ABSTRACT

This work develops the macro-molecule approach [1] for solving the problems of solid mechanics. Usually the particles have finite dimensions. They interact via contacts of their surfaces. The considered macro-molecules are point particles, their dimensions are infinitely small. They interact via their force fields specified by the macro-molecule force characteristic. The required number of macro-molecules is relatively small.

In this work the macro-molecule approach is tested using the reversed-torsion load case for the 30×10×10 (mm) bar made of AlMg6 aluminium alloy (see the left figure). The work has two parts: the experiment part and the calculation part. The experiment is carried out using both the automatic INSTRON torsion machine and the AVERY torsion machine with manual control. The available backlash between the deformed bar and the torsion grip is taken into account. The calculation macro-molecule model (shown within the torsion grip in the right figure) is developed using the MSC.Adams software.





The reversed-torsion load case consists of the nine modes: 1) original backlash mode (optional), 2) one-directional 90º torsion, 3) unloading, 4) backlash mode, 5) 60º torsion in the opposite direction, 6) unloading, 7) backlash mode, 8) 30º torsion in the original direction, 9) unloading. The AlMg6 macro-molecule force characteristic is selected so, that the experiment torsion curve and the calculated torsion curve are as close as possible.

REFERENCES

[1] Sergey V. Arinchev. *Simulation of high-ratio compression of a parallelepipedal duralumin bar using the particle-based method and MSC.Adams software* // CIMNE. Proceedings of the III International Conference on Particle-based methods. – Fundamentals and Applications. University of Stuttgart (Germany), 2013, 18-20 September, Ebook: p. 670-680.