

# Simulation of the response of heterogeneous solid under impulsive loads

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**Introduction:** This paper study the mechanical response of a granular solid subject to an impulse force. The proposed model simulate the behavior of an airport pavement structure. The analysis is performed on a representative volume element (RVE) under thermo-mechanical actions, as those produced by landing gear impact of an airbus A320 and variable high surface temperatures loads.

**Theoretical aspects:** The RVE (Figure 1) is usually regarded as a volume of heterogeneous material large enough to be statistically representative of the material, also containing all the heterogeneous microstructures that are present in the solid. For example, the stress field in a medium RVE can be placed in the form:

$$\langle T \rangle = \frac{1}{V} \int_v T(x) dV_x$$

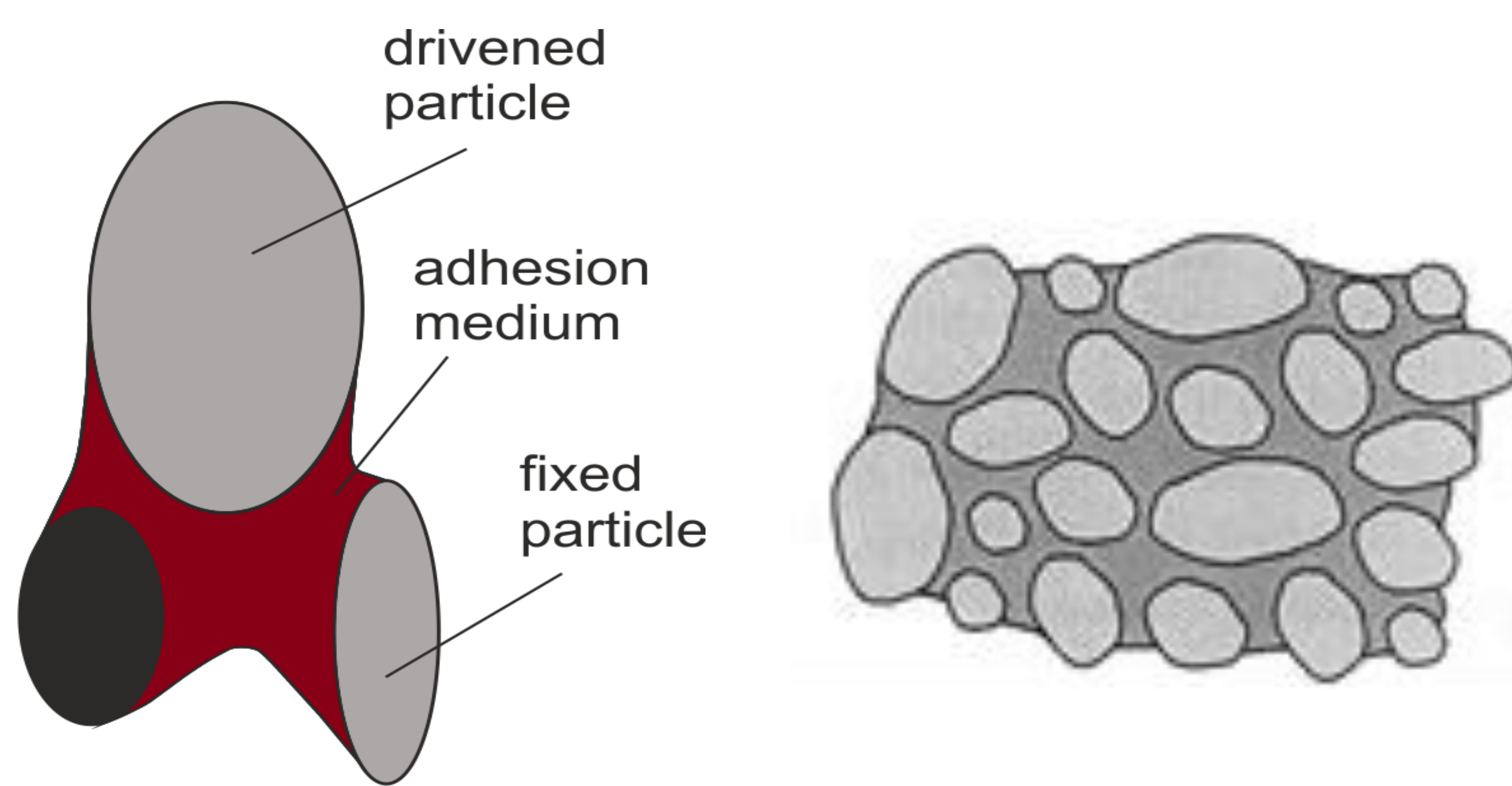


Figure 1. A plane RVE representation

**Numerical simulation and results:** A model of RVE was developed to investigate the response under dynamic actions (by impact and sliding) with addition of thermal actions. The computer code used is COMSOL and FEM implementation involved the use of brick elements with 8 nodes.

We analyzed the state of stress and strain filed at the contact between aggregates comparing the three load conditions (normal loads, thermal surface and normal loads, thermal and normal surface loads after 6 hours).

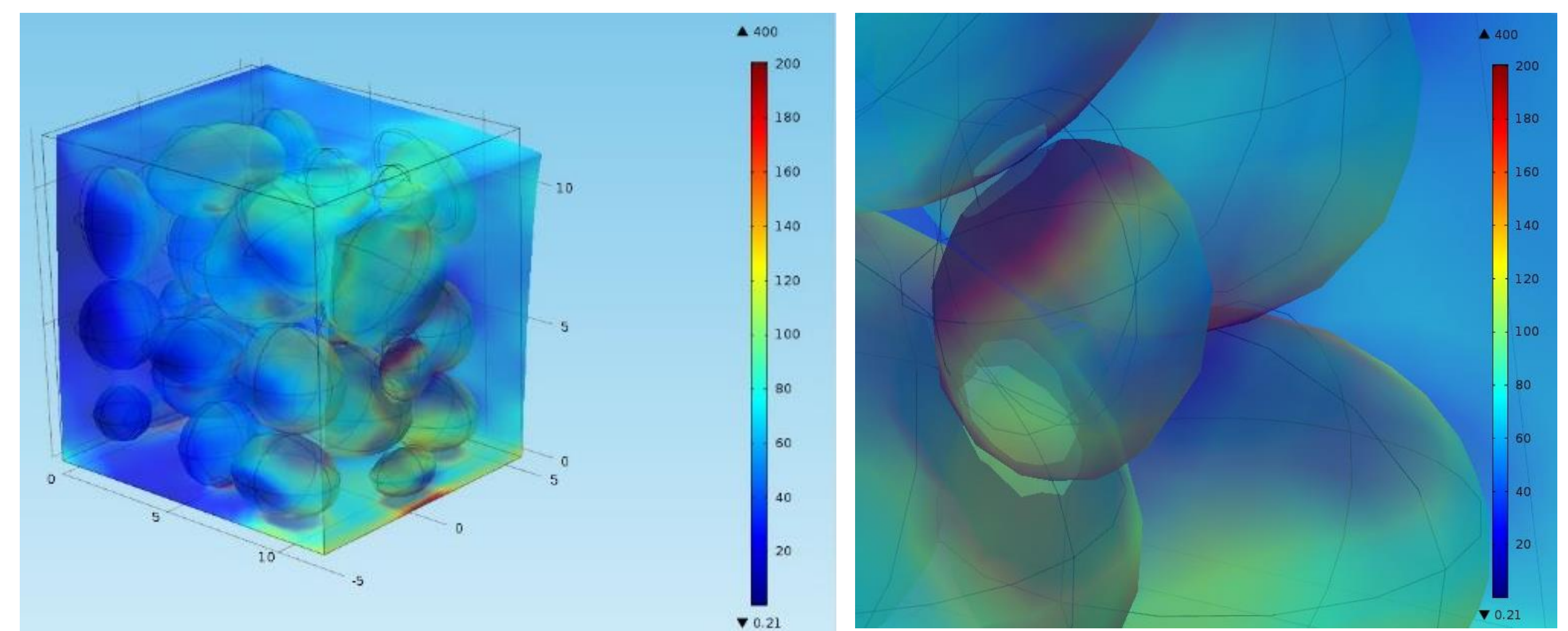


Figure 2. RVE Von Mises stress field

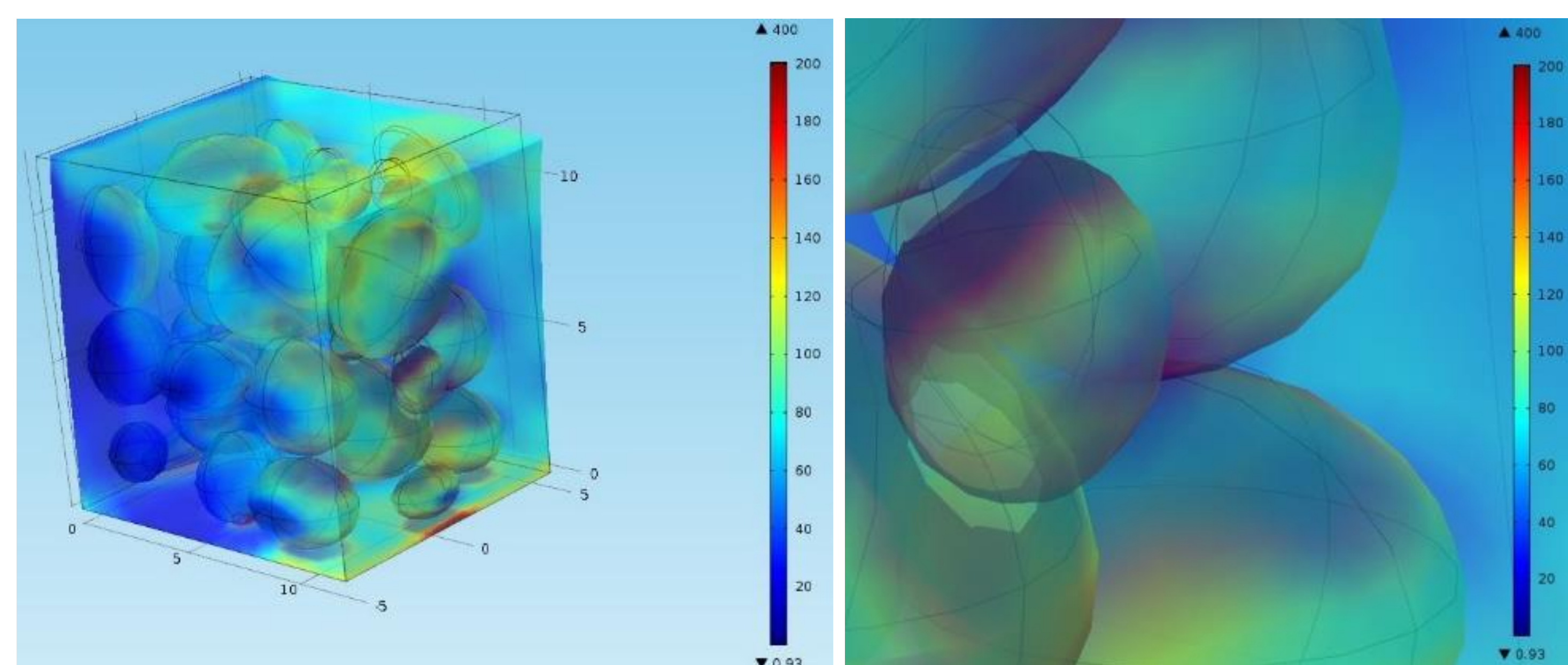


Figure 3. RVE Von Mises stress field (t = 6 h)

**Conclusions:** The illustrated figures report the stress (MPa) filed and the global displacement (cm) filed of the considered RVE in function of the pavement surface temperature. In the numerical simulation, initially the temperature influence is only on the superficial layer, then the heat proceeds inside the pavement and the temperature increases in the deep layers of asphalt conglomerate.

## References:

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