

## **Effect of silica bodies on the mechanical behaviour of oil palm empty fruit bunch fibres**

### **ABSTRACT**

The surface of oil palm empty fruit bunch fibres contains embedded silica bodies or protrusions. The mechanical contribution of the protrusions towards the integrity of the fibres is still not clearly investigated. In this work, 2D and 3D finite element simulations on the surface and cross section of the fibres, respectively, were performed. The information for the models was obtained from scanning electron microscopy analysis and mechanical tests for the silica body characteristics and elastic modulus, respectively. Different silica bodies arrangements and the effect of spiked geometry of the silica bodies was investigated using 2D models. Cohesive zone modelling was introduced to simulate damage or debonding between the interface of silica bodies and fibre. A 3D finite element model was later developed consisting of a silica body (sphere) embedded halfway in the matrix. The numerical results showed that the 2D model was sensitive to critical stress compared to silica bodies spiked geometry, arrangement of silica bodies on the fibre surface, and cohesive energy. On the other hand, the results showed that for 3D models with thicknesses larger than 0.2 mm, the effect of the silica bodies on the elasticity of the fibre was not significant.

**Keyword:** Finite element micromechanics; Cohesive zone modelling; Silica bodies; Fibre interface