A physical model for dynamic analysis of wine barrel stacks

Candia, G., de la Llera, Juan Carlos and Almazán, J.L. (2010). A physical model for dynamic analysis of wine barrel stacks. En: Earthquake Engng. Struct. Dyn., 39: 1063-1081. https://doi.org/10.1002/eqe.979

Abstract

This paper deals with the earthquake response of wine barrel stacks using a physical model of rigid-body components with discrete flexible and damped contact elements. An analytical 3D formulation of the complex dynamic behavior of different barrel stack configurations is presented. Such behavior includes the real geometry of the bodies, large displacements and rotations, the use of non-linear contact elements to account for impact and sliding between bodies, and the resulting local energy dissipation at contact. The parameters defining the physical and mathematical model were calibrated experimentally, and the dynamic behavior of a benchmark barrel stack configuration was compared with the experimental results obtained from the literature. It was found that the model is able to predict the exact mode of collapse and the overall behavior of the system.

Keywords

Wine barrel stacks; Rigid-body dynamics; Contact elements; Rocking and sliding behavior; Top barrel ejection