Viscoelastic layer model for assessing the mechanical properties and viability of articular cartilage using rebound indentation test

Ivan ARGATOV and Gennady MISHURIS

Institute of Mathematics and Physics, Aberystwyth University, UK

We assume that in indentation testing, an articular cartilage sample may be modeled as a viscoelastic layer of finite thickness bonded to a rigid substrate. Following Brown *et al.* (2009), we consider the so-called rebound indentation test, which is composed of two stages. In the first stage, called the indentation phase, the sample is subject to loading at a constant speed v_0 to n_1 per cent strain. That is the indenter displacement is assumed to be specified according to the law

$$w^{(1)}(t) = v_0 t, \quad 0 \le t < t_1. \tag{1}$$

Further, we assume that at n_1 per cent strain the load is immediately removed and the second stage, called the recovery phase, lasts for a theoretically indefinite time. In the recovery phase, we have

$$P^{(2)}(t) = 0, \quad t \ge t_1. \tag{2}$$

We underline that in the first stage, the function $w^{(1)}(t)$ is specified by Eq.(1), while $P^{(1)}(t)$ is unknown. In the second stage, on the contrary, the displacement function $w^{(2)}(t)$ is unknown, whereas the contact loading $P^{(2)}(t)$ is specified by Eq.(2).