

**Title** In-Vivo Acoustic Measurement of Mechanical Properties of Fruits  
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### **Abstract**

The mechanical properties of fruits are important parameters, related directly to the quality, fruit ripeness, etc. The non-destructive acoustic test offers an excellent possibility to measure the hardness of the individual fruits during their maturation, and ripening processes. Based on the results of the previous research works, but adding our own approach for interpretation of sample vibrations, a method was developed and a new mechanical parameter was introduced for in-vivo characterization of mechanical properties of the tested fruits. Both the repeatability, and the reproducibility of the method were tested under field conditions, and they were found to be very encouraging. Repeated tests of individual fruit (apple and pear) samples during their ripening process were performed with high precision and without any destruction. The ambient temperature and the relative humidity were recorded parallel with the firmness tests. Acoustic properties of samples of two apple cultivars and two pear cultivars were recorded every day or every second day in a 30 day period. A combination of two separate hardness-change processes was recorded of different physical causes: a short - one day - period firmness fluctuation, strictly related to the daily fluctuation of the temperature and humidity (turgor-related hardness component) and a long-term softening, related to the physiological changes. This latter change was modelled as a function of the cumulative effect of the ambient conditions to find a prediction model to the optimum harvest date.