Numerical and experimental investigation of leaks in viscoelastic pressurised pipe flow: short period analysis, by S. Meniconi, B. Brunone, M. Ferrante, and C. Massari

***Reply* to Referee #3**

This paper presents an interesting study on pressure transients in viscoelastic pipes with leaks.
As a major comment I appreciate if the authors could cite the paper published by Soares et al. (2011) [Soares, A.K., Covas, D.I.C, Reis, L.F.R. (2011). *Leak detection by inverse transient analysis in an experimental PVC pipe system*, J. of Hydroinformatics, 13(2), 153-166], in which a complex experimental setup made of PVC pipes has been studied considering leaks (damaged pipes as presented in this paper). It was noted that the viscoelastic effect is more important than that one from unsteady friction in PVC pipes (but not quantitatively as in Duan et al., 2010). The same conclusion for HDPE pipes is presented in this paper, but considering a reservoir-pipe-valve (RPV) system.

Reply: We thank Referee #3 for the attention he/she paid to our work. In the revised version of the paper, we will cite the interesting paper by Soares et al. (2011). We excuse for having omitted such a paper in the first version of our work.

I have some minor comments, just to improve the quality of the paper.

1) The authors can trace the wave speed in the experimental setup with leaks by means of the inspecting of time spent between the pressure transducers (points U, D, M), and compare it with the wave speed variation used in the simulations.

Reply: according to this suggestion, we have evaluated the pressure wave speed by considering the time lag between sections M and D, sections M and U: this value is about 384.47 m/s, with a difference with respect to the value used in the numerical simulation (= 377.15 m/s) of 1.9%.

2) The authors possibly used the Kelvin-Voigt model to calculate the viscoelastic term. In this way, the authors should present the parameters of the Kelvin-Voigt model (number of KV elements, creep function etc.). The same requesting is applied to UF model (decay coefficient used).

Reply: We agree with Referee #3 (see also the reply to Referee #2). As a consequence we have modified profoundly the text as it follows: on present page 6 at row 8 we will include the following phrases: "The third term in Eq. (1) takes into account the viscoelasticity of pipe material; the total strain, ε, is given by the following relationship:

$$\varepsilon = \varepsilon_i + \varepsilon_r \qquad (3)$$

where ε_i (ε_r) is the instantaneous (retarded) strain. To simulate the viscoelastic behavior, a single element Kelvin-Voigt model is considered consisting of a viscous damper and elastic spring connecyed in parallel and jointed to a single elastic spring in series. The two components of the total strain can be expressed as:

$$\varepsilon_i = \frac{\alpha}{E_i} \tag{4}$$

$$\alpha = \varepsilon_r E_r + \frac{E_r}{T_r}\frac{d\varepsilon_r}{dt} \tag{5}$$

where α = circumferential stress, E_i (E_r) = instantaneous (retarded) Young's modulus of elasticity, and T_r = retardation time of the damper."

*Moreover at the end of Section 4 the following sentence will be reported: "The model calibration has been executed by considering a leak-free pipe and then tested for an in-line valve pipe (Meniconi et al, 2012a). The resulting values of the parameters are: E_i = 2.2*109 N/m^2, E_r = 8.10*109 N/m^2, and T_r = 0.15 s. For the unsteady friction, the decay coefficient of the relationship proposed by Brunone et al. (1991, 1995), k_d, has been assumed as a function of the initial Reynolds number, according to Pezzinga (2000)."*