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Effect of curvature on the scattering coefficients of Herschel-Quincke tubes

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The concept of Herschel-Quincke (HQ) tubes is known since the beginning of the 20th century and was shown to be of interest to reduce tonal and broadband noise from turbofan engine. To help to understand the physical phenomena underlying the HQ concept, Hallez & Burdisso have developed a 3D theoretical model. The 3D modelling technique considers the tubes-inlet interfaces as finite piston sources that couple the acoustic field inside a hard-walled duct with the acoustic field within the HQ tubes. This model makes a geometrical approximation by considering the tube as a straight duct whereas in reality it corresponds to a curved duct. In this paper, a model is presented which takes into account the curvature of the bend by integrating two differential equations for the pressure and velocity in the bend, projected on the local transverse modes. Results of some typical coefficients of the scattering matrix [S] deduced from the curved HQ model are compared with the 3D straight tube model, the experimental results and the numerical results. The curvature is shown to modify the HQ resonances and then have to be taken into account in the analytical formulation.