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The effect of longitudinal flow on resonantly damped kink oscillations

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Abstract. Many observations of coronal loops show steady flows along the loop axis. The flows are in general sub-Alfvénic. Here we study the effect of an equilibrium flow on resonant absorption of linear kink MHD waves in a cylindrical magnetic flux tube. We are interested in the changes of frequency of the forward and backward propagating waves and also in the modification of the damping times due to the flow. We consider a loop model with both the density and the longitudinal flow changing in the radial direction. We use the thin tube thin boundary (TTTB) approximation to calculate the damping rates. We also solve numerically the full resistive eigenvalue problem, without the assumptions of the TTTB approximation. We derive simple analytical expressions for the linear approximations to the damping rate. The analytical expressions are in perfect agreement with the resistive eigenmode calculations. Under typical coronal conditions the effect of the flow on the damped kink oscillations is small when the density layer is similar or smaller than the width of the velocity layer. However, in the opposite situation the damping rates can be significantly altered, specially for the backward propagating wave.