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Standing kink waves in coronal loops with non-reflective profile of kink speed

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Kink oscillations of coronal magnetic loops with non-reflective kink speed are considered. It is shown that the kink speed is non-reflective if it is either liner or quadratic function of the distance along the loop. When the kink speed is non-reflective, the wave equation describing kink waves in a coronal loop reduces to the Klein-Gordon equation with constant coefficients. The analysis is restricted to the linear kink speed profile. The equilibrium state of the loop is described under the assumption that the loop has a half-circle shape, situated in a vertical plane, immersed in an isothermal atmosphere, and the plasma temperature is the same inside and outside the loop. The eigenfrequencies of the fundamental kink mode and overtones are calculated. It is shown that the ratio of the first overtone eiegenfrequency to the frequency of the fundamental mode is independent of the ratio of the atmospheric scale height to the loop apex height. This implies that the model with the linear kink speed profile cannot be used to obtain the estimate of the atmospheric scale height using the mode frequency ratio. However, it gives the upper boundary for the atmospheric scale height. This upper boundary was calculated for two events where the two frequencies have been observed simultaneously. The results are in good agreement with the estimates of the atmospheric scale height obtained using the model of coronal loops with a half-circle shape and constant cross-section radius.