

# The use of a computer algebra system to illustrate input and output waves for the telegraph equation

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**SAMS Subject Classification: Applications of Mathematics to the Sciences**

It would be difficult to imagine a world without communication systems. In order to optimise communication systems, it is necessary to determine possible power and signal losses in the system, since all systems have such losses. In this paper a mathematical derivation for the telegraph equation in terms of voltage and current for a section of a transmission line is investigated.

The formulae for voltage and current involved in the telegraphic equations are not explicitly and analytically derived in literature for engineers. Also input or output waves for the telegraph equations are not usually given in the literature. This leaves a theoretical and visual gap seldom crossed by students in Electrical Engineering. This is of great concern since most of these students will be working as technicians and they will not really know what they have calculated and what the input and/or output waves look like.

The main aim of this paper is to address this theoretical gap by deriving from basic principles the equations for telegraphic transmission in a guided system and by making use of a CAS to illustrate the shape of the input and/or output waves. Students do all these calculations in either mathematics or engineering but do not know what the signals look like.