Abstract: The current and voltage on an electrical transmission line, e.g. a coaxial cable, can be modeled by means of the telegrapher's equations. While most methods for parameter identification and fault detection for such an infinite dimensional model rely on some finite dimensional approximation, this is not necessary for the algebraic approach presented here. It derives simple polynomial equations relating the concentrated measurements and the unknown parameters by using the Laplace transform and computing characteristic sets for differential ideals. In the end, the identification of parameters and the detection of faults - e.g. a broken isolation between two conductors - requires only the calculation of convolutions of measured signals. The results are illustrated for a signal transmission problem using both experimental and simulation data.