Coaxial induction probe: theory and measurements

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***Abstract*—A coaxial induction probe for simultaneous measurement of object charge, size and distance has been simulated, designed and tested. The sensor has a cylindrical geometry with two coaxial induction probes operating in current mode. Since the probes have different geometry, passing charged object induces different current signals to the probes. Induction signals from both probes are simultaneously recorded and processed using a virtual instrument written in LabVIEW. Signals are first integrated to obtain induced charge as a function of time. A Gaussian curve is then fitted to the data and Gaussian peak parameters are taken to further processing. The system has been simulated using Comsol Multiphysics. According to simulations, shapes of the induction signals are functions of object velocity, size, charge and location. Governing equations which describe the relation between the object variables and signal shapes were determined using simulation data and refined using experimental data obtained with induction charged water droplets and frictionally charged insulating spheres. At the present, object passing the probe must travel at known velocity but this shortage will be addressed in near future. From the probe point of view, a charged sphere will generate signal which is equal to a bubble travelling in charged fluidized bed. Thus, the probe can be used to measure space charge density of powder in a fluidized bed.**