Numerical Simulation of the Electric Field Distribution for Electrostatic Powder Coating of Targets with Surface Perturbations

H.Osman, K.Adamiak,and G.S.P.Castle
Department of electrical and computer engineering
University of Western Ontario, Canada
e-mail: hosman4@uwo.ca

***Abstract*— In electrostatic painting the uniformity and finish quality of the coating is affected by non-uniformities in the electric field distribution on the target surface. This can give rise to such phenomenon as back corona, window panning and the Faraday Cage effect. In this paper, a 2D-axisymmetrical model of a target with sharp edges and recessed areas in an electrostatic powder coating system has been investigated. The surface of the grounded target plate includes a cylindrical cavity, or protrusion, at the center, with varying radii, depths and the radii of curvature of both upper and lower corners. The problem has been solved using the COMSOL, a finite element commercial software package. It has been found that the electric field increases gradually with an increase in the radius of the cylindrical cavity or protrusion. The electric field inside the cavity increases when the cavity depth decreases, assuming that the radii of both corners are fixed. At a fixed value of the radius and the depth of the cavity, the electric field drastically decreases as the radius of the upper corner increases. Moreover, the electric field has been analyzed in the same configurations when a uniform space charge exists between the two electrodes. The electric field intensity at the model corners is high and its value depends on the model parameters.**