

This paper proposes a novel rotor contour design for variable reluctance (VR) resolvers by injecting auxiliary air-gap permeance harmonics. Based on the resolver model with nonoverlapping tooth-coil windings, the influence of air-gap length function is first investigated by finite element (FE) method, and the detection accuracy of designs with higher values of fundamental wave factor may deteriorate due to the increasing third order of output voltage harmonics. Further, the origins of the third harmonics are investigated by analytical derivation and FE analyses of output voltages. Furthermore, it is proved that the voltage harmonics and the detection accuracy are significantly improved by injecting auxiliary air-gap permeance harmonics in the design of rotor contour. In addition, the proposed design can also be employed to eliminate voltage tooth harmonics in a conventional VR resolver topology. Finally, VR resolver prototypes with the conventional and the proposed rotors are fabricated and tested respectively to verify the analyses.