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Effect of off-sized balls on contact stresses in a touchdown bearing

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**EFFECT OF OFF-SIZED BALLS ON CONTACT STRESSES IN A TOUCHDOWN BEARING****Neda Neisi<sup>\*)</sup>, Eerik Sikanen, Janne E. Heikkinen, Jussi Sopenen**

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**Abstract**

Contact stresses of a ball bearing type touchdown bearing with off-sized balls are studied. The touchdown bearing model includes descriptions of the stiffness, damping and friction between bearing components. The model gives the contact deformations between the balls and bearing races, contact forces, and Hertzian contact stresses in each ball. The bearing model is used in simulation together with a model of a flexible rotor. The results show that off-sized ball or balls alters the contact stiffness between the balls and bearing race and the localized deformation of race. The contact force and stresses consequently change. The stress values are dependent not only on the dimension of the off-sized ball or balls but also their location.

Keywords: Touchdown bearing, dropdown, Hertzian contact stress, off-sized ball

**Nomenclature**

$A$	Principal curvature of contact
$a$	Semi-major axis of the elliptic area
$B$	Principal curvature of contact
$b$	Semi-minor axis of the elliptic area
$C$	Damping matrix
$c_r$	radius of air gap
$d$	Diameter of the ball
$\hat{d}$	Distance between inner race and outer race
$E$	Modulus of elasticity
$E^{eq}$	Effective Modulus of elasticity
$e$	Eccentricity
$F$	Force
$F_1$	Vector of nodal unbalance
$F_2$	Vector of externally applied force
$G$	Gyroscopic matrix
$K$	Stiffness matrix
$K$	Contact stiffness
$M$	Mass matrix

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