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MODELING AND ANALYSIS OF BIAS-PLY MOTORCYCLE TIRES

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Abstract—Physical properties of motorcycle tire structures are considered to help select a good and true-to-life mechanistic model suitable for finite element analysis of tires. Rubber and bias-ply layered-cord together make the inflated unhomogeneous tire structure anisotropic and geometrically highly nonlinear.

A mathematical model made of 3-D solid and truss elements is discussed, and presented as realistic and adequate to accommodate the anisotropy and nonlinearity inherent in the tire problem.

Various loading cases, including a cambered tire with inflation pressure and vertical load on contact patch, are studied and evaluated for force and moment acting on the tire. The results are very encouraging and satisfactory.

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STRESS ANALYSIS OF A SIMPLIFIED COMPRESSION PLATE FIXATION SYSTEM FOR FRACTURED BONES†

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Abstract—A three-dimensional finite element model was generated of a plexiglass tube with an attached six-hole stainless steel compression plate to study the mechanics of internal fixation of fractured long bones. To demonstrate the importance of the plate-bone interface, this interface was represented three different ways in the finite element model. A plated tube with a uniform transverse osteotomy gap was also examined to study the mechanics of plated fractured bones. To validate the model, the results for the intact plated tube were compared to composite beam theory and strain gauge data from an instrumented physical model. Applications of the finite element model data included the prediction of screw failure modes, plate-induced osteopenia, and multi-axial strains in an interfragmentary region. The addition of sliding motion between the plate and tube resulted in a deviation from composite beam theory and improved correspondence with strain gage data when compared to a model having the plate and tube securely bonded. Sliding motion resulted in a much smaller region of bone subjected to reduced axial stress levels, which may decrease the extent of plate-induced osteopenia. The complex nature of induced strains in an osteotomy gap was also demonstrated, along with the tendency for failure of the screws nearest the fracture site.