Stress Concentration Trend for Combined Loading Conditions

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Abstract : Stress concentration occurs when there is an abrupt change in geometry, a mechanical part under loading. These changes in geometry can include holes, notches, or cracks within the component. The modifications create larger stress within the part. This maximum stress is difficult to determine, as it is directly at the point of the minimum area. Strain gauges have yet to be developed to analyze stresses at such minute areas. Therefore, a stress concentration factor must be utilized. The stress concentration factor is a dimensionless parameter calculated solely on the geometry of a part. The factor is multiplied by the nominal, or average, stress of the component, which can be found analytically or experimentally. Stress concentration graphs exist for common loading conditions and geometrical configurations to aid in the determination of the maximum stress a part can withstand. These graphs were developed from historical data yielded from experimentation. This project seeks to verify a stress concentration graph for combined loading conditions. The aforementioned graph was developed using CATIA Finite Element Analysis software. The results of this analysis will be validated through further testing. The 3D modeled parts will be subjected to further finite element analysis using Patran-Nastran software. The finite element models will then be verified by testing physical specimen using a tensile testing machine. Once the data is validated, the unique stress concentration graph will be submitted for publication so it can aid engineers in future projects.

Keywords : stress concentration, finite element analysis, finite element models, combined loading
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