Fiber Metal Laminates (FML) are the hybrid composite laminates made by stacking the metal layers with Fiber Reinforced Plastic layers. Incorporating metal layers into the composite construction lead to many advantages. Based on the construction these laminates offers excellent impact resistance, residual and blunt notch strength, flame resistance, high strength/stiffness and good damage tolerance etc. Due to these properties the use of FMLs is increasing in composite structural applications. Extensive characterization is an important step to completely realize the applications of the material. One of the areas of the characterization is the determination of in-plane off-axis strength. Typical failures that influence the off-axis strength of FMLs are the matrix failures, fiber failures and yielding of the metal layers. Many formulations are proposed earlier but these are designed to validate the experimental results obtained during the characterization of specific FMLs. Their applications are limited to the FML for which they have designed and are not useful for other FMLs. One more problem identified is the analytical formulation for determination of off-axis strength of FML consisting of cross-ply GFRP configuration is not yet fully developed. Two new formulations are presented in this thesis to solve the above problems. First one is for characterization of FML consisting of cross-ply
GFRP laminas and aluminum layers and the developed analytical formulation proved useful for predicting the off-axis strengths and also to estimate the failures. Second formulation is to use as a common formulation for various types of FMLs. Two new degradation models are proposed as a part of these formulations.

The first degradation model is based on Tsai-Hill terms for reducing the properties of the failed lamina. The second degradation model considers the failure status of the adjacent lamina for determining the property reduction coefficients. Both the concepts are new and are not proposed earlier. The formulations are validated by comparing the formulation predictions with experimental results. Magnesium based FMLs are the new entry to the area of FMLs and their off-axis strength that is not reported earlier is predicted by using the above formulation. Their off-axis strength behavior is compared with the aluminum based FMLs.