# Chapter 4 - Fuzzy attack tree analysis of security threat assessment in an internet security system using algebraic *t*-norm and *t*-conorm

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## Abstract

In this fast-growing world, the internet has become one of the important tools of modern society in various ways, such as communication, transactions, security, and real-time monitoring. At the same time, internet security threats play a crucial role in accomplishing all the intended tasks safely. So internet security threat assessment becomes a greater concern due to the advancement of information technology. To analyze internet security threat assessment, a novel fuzzy attack tree analysis (FATA) method under uncertainty has been proposed in this chapter. The method integrates attack tree analysis (ATA) for modeling the problem, triangle intuitionistic fuzzy set (TIFS) for quantifying data uncertainty and hesitation factor, while algebraic *t*-norm and *t*-conorm–based arithmetic operations defined on TIFS are applied to evaluate membership and nonmembership degrees of top goal failure probability in terms of TIFS. The benefit of using algebraic *t*-norm and *t*-conorm–based arithmetic is that they involve membership and nonmembership degrees of each bottom event in evaluating top goal failure probability in terms of TIFS. The proposed FATA method has been applied to analyze the fuzzy failure probability of a security threat in an internet security system. The computed results are compared with results obtained from three other existing methods to show the effectiveness of the proposed FATA method. The results conclude that the proposed FATA method optimizes the prediction range of failure probability at any cut level $\alpha$.