Nikolaos I. Ioakimidis, 2022, An application of Ben-Haim's info-gap decision theory (IGDT) to Todinov's method of algebraic inequalities by employing the method of quantifier elimination, Technical Report, October 2022, DOI: 10.13140/RG.2.2.30031.36000

Abstract Problems under uncertainty conditions can be studied by using the very interesting and popular Ben-Haim's info-gap (or information-gap) decision theory (IGDT). On the other hand, recently, Todinov proposed an interesting and efficient method based on algebraic inequalities for the reduction of risk and uncertainty as well as for the generation of new knowledge and the optimization of systems and processes. One of the main problems where Todinov applied his new method is the problem concerning the equivalent resistances of n resistors in an electrical circuit connected both in series and in parallel. Here we consider the same problem, but now with the related algebraic inequality used as the performance requirement in Ben-Haim's IGDT. The methodology used here is based on the computational method of quantifier elimination. This method constitutes a very interesting approach for the transformation of quantified formulae to logically equivalent formulae, but now free from the quantifiers and the quantified variables. The same method is implemented in some computer algebra systems including Mathematica, which is used here. The problems studied here and related to the equivalent resistances of two or three resistors concern (i) two resistors with one horizon of uncertainty including the cases of parametric nominal value(s) of one resistance or both resistances here by using a fractional-error uncertainty model in Ben-Haim's IGDT, (ii) two resistors again, but with two horizons of uncertainty, (iii) three resistors with one horizon of uncertainty and (iv) two resistors again, but with the use of an ellipsoidal uncertainty model. The use of negated existentially quantified formulae instead of universally quantified formulae is also studied.

Keywords Uncertainty, Info-gap, Information-gap, Ben-Haim's IGDT, Fractional-error model, Ellipsoidal model, Uncertainty parameter, Horizon of uncertainty, Non-probabilistic methods, Reliability, Risk reduction, Uncertainty reduction, Algebraic inequalities, Todinov's method, Resistors, Equivalent resistances, Quantifier elimination, Quantifier-free formulae, Mathematica

---

\website\IGT\ioakimidis2022abs002.tex 11.10.2022