

# Advances in Mathematical Inequalities and Applications

Milica Klarinčić Bakula 

Faculty of Science, University of Split, Ruđera Boškovića 33, 21000 Split, Croatia; milica@pmfst.hr

## 1. Introduction

Why do we study inequalities? The answer to this question was given by Bellman in [1], in a very concrete and elegant fashion: “There are three reasons for the study of inequalities: practical, theoretical and aesthetic. In many practical investigations, it is necessary to bind one quantity to another. The classical inequalities are very useful for this purpose. From the theoretical point of view, very simple questions give rise to entire theories. For example, we may ask when the nonnegativity of one quantity implies that to another. This simple question leads to the theory of positive operators and theory of differential inequalities. Another question which gives rise to much interesting research is that of finding equalities associated with inequalities. We use the principle that every inequality should come from an equality which makes the inequality obvious. Along these lines, we may also look for representation which makes inequalities obvious. Often, these representations are the maxima or minima of certain quantities. Finally, let us turn to aesthetic aspects. As has been pointed out, beauty is in the eyes of the beholder. However, it is generally agreed that certain pieces of music, art or mathematics are beautiful. There is an elegance to inequalities that makes them very attractive”.

In this Special Issue, we present new results related to classical inequalities, such as the Jensen inequality, Jensen–Steffensen inequality, Jessen inequality, Grüss inequality, Chebyshev inequality, etc. They have various applications in various branches of mathematics, among which are numerical analysis, probability and statistics, as well as in other sciences, such as information theory.

## 2. Statistics of the Special Issue

A total of 30 papers were submitted for this Special Issue, of which 10 were published (33.33%) and 20 were rejected (66.67%), indicating a rigorous peer review process.

## 3. Overview of the Contributions to the Special Issue

1. Barotov, D.; Barotov, R.; Soloviev, V.; Feldin, V.; Muzafarov, D.; Engashboev, T.; Egamov, K. The Development of Suitable Inequalities and Their Application to Systems of Logical Equations. *Mathematics* **2022**, *10*(11), 1851; <https://doi.org/10.3390/math10111851>.

<https://www.mdpi.com/2227-7390/10/11/1851>

In this paper, two uncomplex inequalities are invented and intricately established, adequately describing the behaviour of discrete logical functions  $or(x_1, x_2, \dots, x_n)$  and  $and(x_1, x_2, \dots, x_n)$ . Based on these proven inequalities, infinitely differentiable extensions of the logical functions  $or(x_1, x_2, \dots, x_n)$  and  $and(x_1, x_2, \dots, x_n)$  were defined. These suitable extensions were applied to systems of logical equations. Specifically, the system of  $m$  logical equations is first transformed in  $R^n$  into an equivalent system of  $m$  smooth rational equations (**SmsRE**) in a constructive way, without adding any equations (field equations or otherwise), such that the solution of **SmsRE** can be reduced to the problem minimization of the objective function, and any numerical optimization methods can be applied, since the objective function will be infinitely differentiable. Transforming **SmsRE** into an equivalent system of  $m$  polynomial equations (**SmsPE**) means that any symbolic



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# Mathematical Inequalities

**Michael Rajnik**



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