



Technical Note

Automating specialized mineral processing calculations with an accurate and fast Excel add-in

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(Received: 30 August 2025, Revise: 17 October 2025, Accepted: 07 November 2025)

DOI: [10.22034/anm.2025.23599.1694](https://doi.org/10.22034/anm.2025.23599.1694)

Keywords

Microsoft Excel
Mineral Processing
Specialized Add-In
Excel Functions
Programming

English Extended Abstract

Summary

Performance evaluation of processes in the mining industry—particularly in mineral processing units—relies heavily on the application of complex and often lengthy mathematical formulas and relationships. Microsoft Excel, as one of the primary tools for computation and data analysis in scientific and industrial domains, has long been widely used by engineers and researchers. Despite its diverse capabilities, Excel lacks many of the specialized formulas required in the field of mineral processing. This deficiency has compelled many professionals to spend considerable time manually writing complex formulas and combining general-purpose functions. Such practices are not only prone to computational errors and mistakes arising from unit conversions and misinterpretation of formulas, but also significantly reduce the accuracy and efficiency of specialized calculations.

Introduction

Utilizing Microsoft Excel for mineral processing requires the manual construction of necessary formulas and relationships by combining built-in functions. This approach is often time-consuming and susceptible to errors during the formula-writing process.

It is evident that engineers may inadvertently make mistakes when converting scientific relationships into Excel formulas. More importantly, before any formula is written in Excel, it is essential to extract and study the most accurate relationship from reliable sources. In some cases, discrepancies exist in the presentation of a formula across different books and articles. Identifying the correct version among them demands both expertise and a deep understanding of the subject matter.

Additionally, it is sometimes necessary to carefully examine the units of all input parameters in a given function. This is because certain relationships in mining and mineral processing are based on the metric system, while others follow the imperial system. Neglecting unit conversions and measurement systems can be a major source of computational errors. In summary, errors in mineral processing calculations may arise from the following factors:

- Inconsistencies in relationships presented across different sources
- Lack of precision in Excel formula construction



- Failure to account for input variable units and necessary unit conversions

In some cases, reaching the final result of a problem requires multiple lengthy and non-continuous calculation steps, demanding extensive formula writing in Excel.

To address this challenge, the development of a tool that provides standardized and validated mineral processing formulas in the form of ready-to-use and reliable Excel functions is a clear necessity in mining engineering and related industries. In response to this need, the present study introduces a specialized Excel add-in that currently offers more than 50 key mineral processing formulas as built-in functions. The development process involved extracting and rigorously evaluating formulas from authoritative sources, implementing them using the C# programming language, compiling a user guide, and publishing the add-in on the GitHub platform.

Once installed, the add-in integrates a dedicated category named “Mineral Processing” into Excel’s function library, enabling users to perform complex calculations quickly and accurately. By facilitating access to trusted formulas and minimizing the risk of errors, this tool represents a significant advancement in improving the precision, speed, and reliability of mineral processing computations. It offers a practical solution for engineers and researchers seeking to streamline their analytical workflows and enhance decision-making in mining operations.

Results and Conclusions

This study was conducted in three distinct phases. The first phase involved a thorough review of the most reputable references in the field of mineral processing to compile a comprehensive list of essential formulas. During this stage, some formulas were found to differ across credible sources. Identifying the correct version among these variations was one of the most critical and time-consuming aspects of the research. Another key task in this phase was the standardization of all input variables based on the International System of Units (SI). Although many formulas were originally expressed in metric units, those based on imperial units were converted to metric to ensure consistency. Ultimately, a curated list of more than 50 mineral processing formulas was compiled.

The second phase focused on programming and developing an add-in to integrate these formulas into Microsoft Excel. While all versions of Excel offer a basic development environment known as VBA (Visual Basic for Applications), which allows users to create custom formulas, VBA is generally suitable only for simple calculations with low computational demands. Moreover, VBA has significant limitations, making it unsuitable for implementing complex formulas or those requiring specialized algorithms or external libraries. Although initial development of the add-in began in VBA, the process was eventually transitioned to the C# programming language, where it was completed.

The third and final phase of the project addressed user accessibility. Recognizing that clear guidance is a vital component of any specialized software, a comprehensive user manual was developed in English to ensure compatibility and ease of use within the Excel environment.

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*Journal of Analytical and Numerical
Methods in Mining Engineering*

Journal home page: <http://anm.yazd.ac.ir/>



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