

**RESEARCH ON THE APPLICATION OF QFORM SOFTWARE FOR
ROLLING SMALL-SIZED CONICAL BILLETS**

Professor, Berdiyev Darob Muratovich,
Scientific Secretary of the Scientific and Technical
Center for Radiation and Nuclear Safety,

Associate Professor, Saydumarov Botir Muradovich,
Department of Metal Technologies Faculty of Mechanical
Engineering Tashkent State Technical University,

Associate Professor, Tashmatov Ravshan Kobilovich,
Head of the Department of Technological Machines
and Equipment, Almalyk State Technical Institute

Senior Lecturer, Xasanov Kamoliddin Akmal o'g'li
Department of Metal Technologies Faculty of Mechanical
Engineering, Tashkent State Technical University,

Master's Student, Mo'minov Afzalsho Oljabay o'g'li
Master's Student (Group 60M-25) Tashkent State Technical University

Introduction. The development of a rolling process technology regime using simulation with the QForm software package for forming the base of a cutting tooth used in mineral extraction from 35XGSA steel billets produced by JSC "Uzmetkombinat" is considered one of the urgent problems. The rolling process is a metal forming process in which the material is deformed by passing it between rolling rolls, and it is widely used in industry. Conical workpieces (billets) are often required for products such as bushings, pins, and conical adapters. In traditional experimental production, the development of such parts requires significant time and resources. Therefore, preliminary verification and optimization of the technology through computer simulation is an effective solution.

QForm is a software package based on the Finite Element Method (FEM) used for simulating rolling processes and other metal forming operations. It calculates parameters such as deformation, force, temperature, and friction for complex processes, and also predicts potential defects and errors in the process.

| | |
|----------|--|
| 1 | ISSN 2277-3630 (online), Published by International journal of Social Sciences & Interdisciplinary Research., under Volume: 15 Issue: 04 in April-2026 https://www.gejournal.net/index.php/IJSSIR |
| | Copyright (c) 2026 Author (s). This is an open-access article distributed under the terms of Creative Commons Attribution License (CC BY). To view a copy of this license, visit https://creativecommons.org/licenses/by/4.0/ |

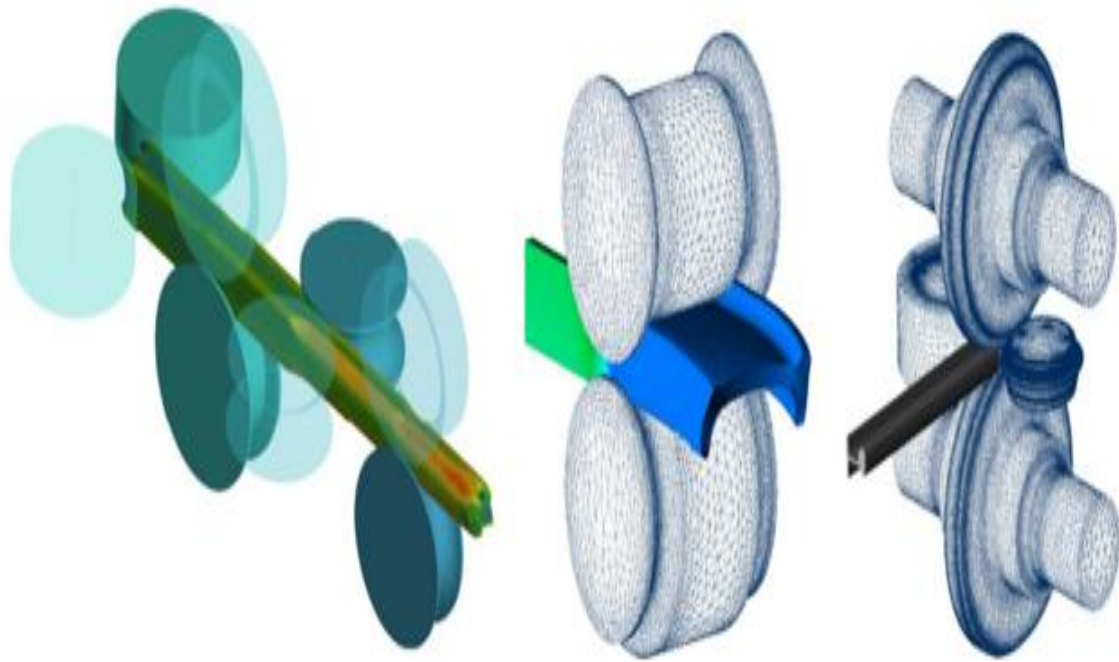


Figure 1. Capabilities of the QForm Software

QForm has strong capabilities in performing the following tasks:

1. simulation of rolling processes in a 3D model;
2. calculation of deformation zones and stress–strain distribution;
3. parametric variation of friction, temperature, tooling, and material properties;
4. modeling of complex-shaped workpieces and dynamic processes.

These capabilities make the simulation of the rolling process of conical billets accurate and realistic.

The rolling process proceeds as follows:

1. An initial billet without a conical shape is prepared (e.g., a cylinder or a small conical starting form).
2. The desired conical angle is imparted to the billet using rolls and auxiliary tools.
3. Significant deformation, force, temperature, and flow processes are simulated using QForm.

The complexity of the process lies in the fact that, due to the conical shape, deformation varies along each dimension, which greatly affects friction, force, and energy requirements.

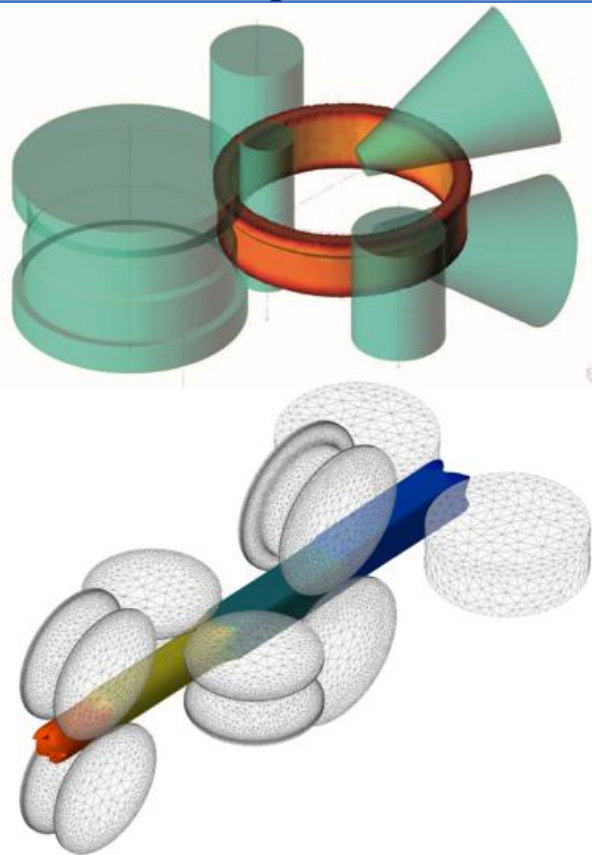
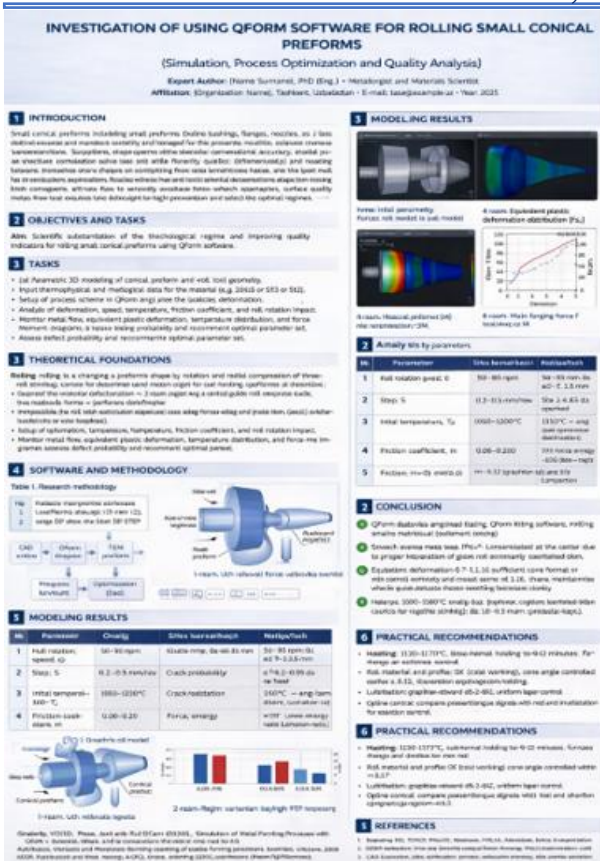


Figure 2. Simulation in QForm Software

Creation of the Working Model

1. The geometry of the workpiece (conical shape) is created in CAD software and imported into QForm.
2. Models of the rolls and the mill mechanism are also imported.

This stage is applied according to the validated methodology and verifies the process through laterally based simulations.

Setting Material and Process Parameters

In QForm, the following parameters are specified: 1. Material properties (temperature, elastic-plastic model), 2. Friction coefficient, 3. Roll velocity, 4. Workpiece temperature, 5. Exit conditions.

These parameters allow for a precise visualization of the metal flow and deformation mechanisms.

Stress and Strain Distribution

QForm analyses provide the following information:

1. Degree of deformation at each point (PEEQ)
2. Temperature variation
3. Distribution of forces and moments
4. Energy consumption

These indicators are crucial for evaluating the accuracy and quality of the process.

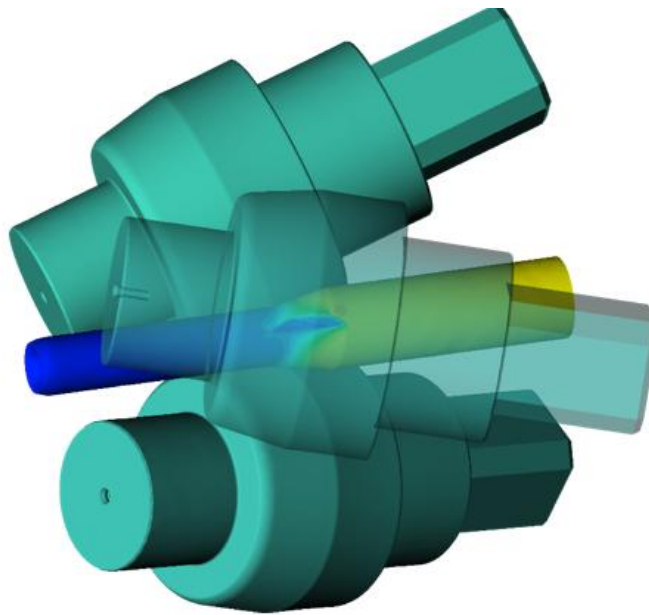


Figure 3. Simulation of Cross Rolling Using QForm Software

Experimental Validation and Application

Simulation results obtained using QForm are often compared with laboratory or production tests. This method allows potential defects to be identified and the process technology to be optimized.

For example, in metal rolling processes, there are scientific studies where QForm simulations were used to analyze the design of pipes and billets, as well as the parameters of rolling mills.

Conclusion and Recommendations

1. The QForm software is a convenient tool for accurately modeling the rolling process of conical billets.
2. FEM-based analysis allows for optimization of process parameters and early detection of potential defects.
3. Conducting simulations before production significantly reduces time and costs.
4. Recommendation: combining simulation with laboratory tests enhances the results and increases reliability.

References

1. Saydumarov B.M. Prokatlash mashinalari va jihozlari. Darslik. Toshkent: TDTU, Bookmany print, 2026. 267 b.
2. Saydumarov B.M. Prokatlash uskunalari loyihalash. Darslik. Toshkent:TDTU, Bookmany print, 2023. 236 b.

3. Humphreys F.J., Hatherly M. *Recrystallization and Related Annealing Phenomena*. Elsevier, 2004.

4. Allenov, M. G., & Belokurov, O. A. (2020). Evaluation of the Friction Factor Influence on the Results of Cross-Wedge Rolling Simulation in QForm Software. *Solid State Phenomena*, vol. 299, pp. 494–500. <https://doi.org/10.4028/www.scientific.net/SSP.299.494>

5. Guseynov, E. R., Aleshchenko, A. S., Fortunatov, A. N., & Korol', A. V. (2025). Experimental study of tool wear in the production of seamless hot-rolled pipes using QFORM software package. *Chernye Metally*, 10, 52–58.

6. Gerasimov, D., & Gartvig, A. (2016). Parallel computing of metal forming simulation in QForm software. *Computer Methods in Materials Science*, 16(3), 139–142. <https://doi.org/10.7494/cmms.2016.3.0582>

7. Saydumarov B.M. Prokatlash jo'valarining konstruksiyasi, ishlash sharoiti, ekspluatatsion xossalarini tahlili va ularning chidamliligini oshirish usullari. *Kompozitsion Materiallar*. №1, 2026 (215-216).