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Teaching mechanics with individual exercise assignments and automated correction

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The presented project aims to improve the education of engineers in mechanics. We believe that the independent solving of exercises is an indispensable part of developing a student's mechanical understanding. Yet, most mechanics lectures have more than 200 participants, and from the teacher's point of view, the effort of manually creating and correcting assignments limits the number of exercises. However, a small number of assignment examples makes it considerably more difficult to check whether students could solve them themselves. For students, on the other hand, unreflected copying of tasks already solved does not foster the understanding of the material to be learned and leads to a false self-assessment.

We address this "classical issue" of homework assignments by providing a scalable approach for creating, distributing, and correcting them.First, problem sets with a similar level of complexity are assembled by abstract modification rules and symbolically solved to obtain the reference solutions. Second, the generated problems, the assignment instructions, and the corresponding reference solutions are incorporated into a file format that the moodle-based teaching platform can interpret. This file also includes the rules for the correction of student answers. Once uploaded to the moodle-based platform, the pool of automatically generated assignments is ready to use as a moodle STACK question: they can be assigned to tests, randomly distributed to the students, and automatically corrected once students provide their answers. As a result, students get individual exercises and receive direct feedback once they submit their answers. This automated interaction allows students to hand in their assignments several times to improve their work. Thus, mistakes are not "punished" but enable students to learn from them.

We present several examples of problems related to statics, strength of materials, dynamics, and hydromechanics, which have been realized with this scalable homework concept, and discuss challenges in the concept's implementation.