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| Division of Mechanical Science and Engineering                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | Research field                                                                                            | Computational Mechanics of Materials | Lab. ID<br>ME11 |
| Laboratory web site                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | <a href="https://sites.google.com/view/comm-lab">https://sites.google.com/view/comm-lab</a> [in Japanese] |                                      |                 |
| Research subjects                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |                                                                                                           |                                      |                 |
| <p>The strength of materials emerges from the interactions and collective behavior of vast numbers of atoms and lattice defects. The resulting stresses and deformations, in turn, influence microscopic behavior. Our research explores this two-way relationship by asking: What defines an “individual” within a collective?</p> <p>Using molecular dynamics and other simulation approaches in computational mechanics of materials, we connect scales spanning atoms, dislocations, grain boundaries, and microstructures. We seek to clarify how individual events propagate to shape collective behavior and how the collective determines the role of each individual. In particular, by examining which microscopic details should be averaged out and which should be retained, we aim to identify the essential degrees of freedom that govern material strength.</p> <p>By establishing connections between atomic-scale interactions, microstructural evolution, and macroscopic mechanical responses, we seek to develop a fundamental understanding of material strength and guiding principles for controlling strength and deformation behavior.</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                                                                                                           |                                      |                 |
| Master/Doctor course: Education policy, curriculum, typical activity in the laboratory                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |                                                                                                           |                                      |                 |
| <p>Our laboratory fosters researchers and engineers who can identify problems and take the initiative in solving them through research on the interplay between microscopic and macroscopic behavior that governs material strength. Each student pursues an individual research topic, with guidance tailored to their interests and progress. Through repeated cycles of planning, execution, evaluation, and improvement, students develop expertise, problem-solving skills, logical thinking, and the ability to communicate their findings effectively. In the master’s program, students build a foundation for independent research by mastering research methods and elucidating specific deformation mechanisms. In the doctoral program, they build on this foundation to formulate original research questions, develop models that bridge scales, and make new scholarly contributions.</p> <p>Through seminars and reading groups, students systematically acquire knowledge and skills in computational mechanics of materials, including programming, crystal plasticity, dislocation theory, and molecular dynamics. They progress through literature reviews, simulation planning and execution, analysis and interpretation of results, and scientific writing, according to their research topics. Beyond obtaining computational results, we emphasize understanding model assumptions and limitations, assessing the validity of results, and extracting essential features from large amounts of information.</p> <p>As part of ongoing research supervision, students report their activities weekly via Slack and use faculty feedback to plan the following week’s work. At the end of each month, they prepare written research reports and develop their ability to structure arguments logically and express ideas in academic language through feedback and revision. Research progress meetings are held every two to three months, providing opportunities for presentations and discussions involving all laboratory members. These meetings help students examine research from diverse perspectives and strengthen their presentation and discussion skills. Students also present at conferences and write research papers, broadening their perspectives through interactions with researchers within and beyond the laboratory while bringing their findings together in a master’s thesis or doctoral dissertation.</p> |                                                                                                           |                                      |                 |
| Daily life in the laboratory, etc.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |                                                                                                           |                                      |                 |
| <p>Our laboratory provides an environment where each student can focus on their research and turn ideas into reality. Every student has a dedicated desk and computer with multiple monitors, offering a workspace for focused work—from literature reviews and programming to the visualization and analysis of simulation results and scientific writing. We also provide computing resources for large-scale simulations, supporting students in pursuing their research independently.</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |                                                                                                           |                                      |                 |
| Message or comments by the laboratory faculty staffs                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |                                                                                                           |                                      |                 |
| <p>Encountering a phenomenon no one has ever seen, or finding an idea that explains a previously hidden mechanism—the thrill of those moments is what keeps me pursuing research. I hope you will experience that excitement as often as possible.</p> <p>Unfortunately, I know of no shortcut to discovery. Even when things do not go as planned, we keep examining the results carefully, thinking, testing ideas, and persistently working through the challenges. I believe that these steady efforts lead to new discoveries. Of course, you do not have to struggle alone. Through discussions with me and your fellow lab members, we can explore our questions more deeply together.</p> <p>Join us in exploring the “complex yet beautiful collective behavior of atoms” with curiosity and excitement. I look forward to sharing the joy of discovery with you.</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |                                                                                                           |                                      |                 |
| Laboratory mail address                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | Tomotsugu Shimokawa <simokawa *at* se.kanazawa-u.ac.jp>                                                   |                                      |                 |