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The Open-Source Particle-In-Cell Code SMILEI

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Started in 2013, the electromagnetic PIC code SMILEI has achieved significant progress, both on the physics and performance aspects. To match its open-source and community-driven approach, it is now well documented and has a user-friendly design. New physics modules include collisions, ionization, radiation reaction, multiphoton Breit-Wheeler pair creation, an envelope model for laser-plasma ponderomotive interaction, and cylindrical geometry with azimuthal Fourier decomposition. High scalability and performance are ensured with a hybrid shared/distributed-memory parallel computation, a space-filling-curve dynamic load-balancing technique, and a novel, efficient adaptive vectorization method. Particle merging and splitting processes bring additional control on the performance. These aspects will be reviewed. Large-scale simulations relevant to laser-plasma interaction, particle acceleration or astrophysics, and performed by the SMILEI community will also be presented.

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