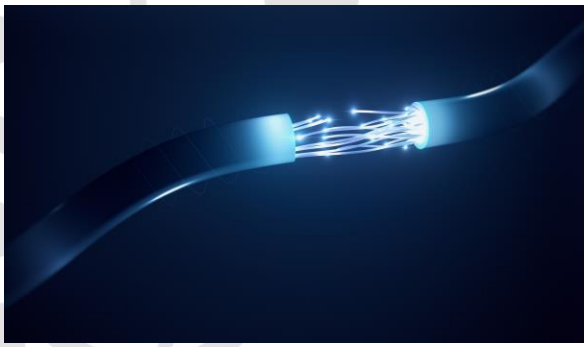
OPTIMIZING POWER FLOW



Bissan Ghaddar

The better you can optimize the flow of electricity in a power grid, the more energy you save and the fewer planet-warming greenhouse gases you generate. But that's easier said than done.

Supply and demand fluctuate month by month, day by day and hour by hour. On top of that, there are a host of constraints to take into account. To date, no one has come up with an algorithm that can consistently find the optimal answer in every situation — at least, not in a reasonable length of time. Instead, grid managers use approximations. And each year, the difference between "approximate" and "accurate" adds up to billions of dollars of wasted money around the world.

Waterloo operations research expert Dr. Bissan Ghaddar recently teamed up with colleagues at IBM Research to come up with a closer answer, thanks to some sophisticated mathematics.

They focused on two of the main factors that make optimal flow so difficult to calculate: so-called non-convexities due to the non-linear physical constraints and the sparse structure of the power network. Ghaddar and her team treated the issue as a sparse polynomial optimization problem and used strong and efficient convexifications to find the optimal solution while making the calculations more manageable.

When Ghaddar and her colleagues applied their approaches on different test cases, they came up with accurate answers every time in smaller-scale grids. For bigger grids, they produced significantly better results than current methods. And when we're talking about a billion-dollar problem, those improvements mean very significant savings.

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