Understanding Knots

MEHVISH POSHNI AND IMRAN FARID KHAN
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Husband and wife scientific teams are not new—think Pierre and Marie Curie—and Columbia Engineering provides an environment that Mehvish Poshni and Imran Farid Khan found welcoming.

Both are PhD students in the Department of Computer Science, with an emphasis in topological graph theory. Both are working with Professor Jonathan Gross. Both are Fulbright Scholars and came to Columbia Engineering from their native Pakistan, and each hopes to return after earning their terminal degrees to become professors in their homeland.

They say that balancing their five-year marriage with their shared career pursuit is not as complicated as it might seem to others. “We have never had to consciously balance work and life,” says Poshni. “It happens naturally.”

It certainly does not seem as complex as the topological graph theory they are exploring. Professor Gross explains that discovery in this field is an objective in its own right and that the motivating factor is rarely to seek a direct practical application. There is the potential for an eventual one, however, in the work the couple is doing with Gross.

“A potential application of our work on topological aspects of network layouts is to the design of computer chips, which could be realized by augmenting our topological models with geometric specifications,” Gross says. “Our present work on knots is aimed at developing a theory of design for the graphic art forms called ‘Celtic knots,’ with the expectation that this will lead to a theory encompassing all knots. Knot theory is applicable to things as far apart as textiles and string theory in physics. Nonetheless, our focus is on the mathematics, rather than on these or any other applications.”

Poshni said that such theoretical flavors were what initially attracted them to Columbia Engineering. “It was one of the few programs that both my husband and I felt could provide the kind of academic development we were at the time looking for,” she said.

“Mehvish and I have been jointly working with our adviser on developing methods for computing genus distribution of various families of graphs,” Khan said. “Most of the prior work in this problem area by others had dealt with specific families of graphs, whereas the methods that we have been developing are more generic.”