Department of Mathematical Sciences welcomes

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On the properties and applications of Hankel operators and matrices

NOTE TIME CHANGE DUE TO 2 SPEAKERS THIS WEEK.

September 20, 2019

Hosted by:
Prof. Alexander Its

Tea begins at 2:30
in LD 259

Research Topic
begins at 4:15
in LD 229

ABSTRACT:

Hankel operators form one of the most important classes of bounded linear operators with various applications in several areas of analysis, such as function theory, harmonic analysis, moment problems, asymptotic analysis, spectral theory, orthogonal polynomials, random matrix theory and mathematical physics. The most important settings include Hardy, Bergman and Fock spaces. In Hardy spaces, their importance is often realized through their matrix representations, which makes them suitable for many applications (e.g. Widom's proof of Szegö's strong limit theorem for the 2D Ising model). In the other two cases, their study is particularly important in connection with problems in quantum mechanics and several complex variables. Another important aspect about Hankel operators is their use in the study of Toeplitz operators and matrices, which goes back to the fundamental paper of Gohberg and Krein in 1960. Indeed, Widom's identity for the product of two Toeplitz operators makes this connection crystal clear, and it naturally leads to the question of compactness (and Schatten class membership) of Hankel operators. In this talk, I discuss Hankel operators in their various forms, starting with Nehari's description of bounded Hankel matrices and Hartman's characterization of their compactness, their generalizations to the three function spaces, Toeplitz plus Hankel operators, their index theory and open problems. I will also present a new proof (using limit operator techniques) of the result that the Hankel operator H_f is compact on Fock spaces if and only if $H_{\overline{f}}$ is compact, which was previously proved for Hankel operators on the Fock-Hilbert space by Berger and Coburn using methods unsuitable for other Fock spaces. As a bonus, our proof fully explains that this striking result is caused by the lack of nonconstant bounded analytic functions in the complex plane (unlike in the other two spaces), extends the result from the Fock-Hilbert space to all Fock-Banach spaces, and shows that compactness is independent of the underlying space.

ABOUT THE SPEAKER:

Jani Virtanen is an associate professor and the leader of the operator theory research group at the University of Reading, England. His research interests include operator theory, complex analysis, spectral theory and their applications. Before joining the University of Reading, he was a Marie Curie fellow at the Courant Institute of Mathematical Sciences in New York City and an Academy of Finland postdoctoral fellow at the University of Helsinki in Finland.

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