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The Fokas method for the analysis of dispersive PDEs in domains with a boundary

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The Fokas method, also known as the unified transform, is one of the most remarkable breakthroughs noted in the area of linear and integrable nonlinear partial differential equations at the turn of the new millennium. Its numerous implications along with the elegance of the ideas forming its foundation inspired the great Israel Gelfand to once describe it as the most exciting development in the area of PDEs since the time of Fourier. This talk will offer further evidence in support of this statement by explaining how the Fokas method is the natural analogue of the celebrated Fourier transform, which is the fundamental tool used in the analysis of nonlinear dispersive PDEs in the initial value problem setting, for studying these PDEs in the initial-boundary value problem setting. Indeed, in recent years, the unified transform has provided the foundation for a new approach for proving the well-posedness (existence, uniqueness, and stability of solution) of general nonlinear (i.e. not necessarily integrable) dispersive PDEs when these are formulated in domains with a boundary and *nonzero* boundary conditions. Concrete examples such as the general semilinear Schrödinger equation and the Korteweg-de Vries equation will be reviewed with various types of boundary conditions, in one as well as in two spatial dimensions. This is joint work with Thanasis Fokas, Alex Himonas and Fangchi Yan.