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Integral Deferred Correction.

In this talk we will discuss a class of defect correction methods we have been developing, which are motivated by Spectral Deferred Correction (Dutt, Greengard and Rokhlin, BIT-2000), SDC. The relation between SDC and our approach is that the correction step is reformulated so that the integral of the residual appears in the correction equation, rather than the derivative of the residual. Because it is the integral of the residual appears in the correction loop, we have dubbed the method Integral Deferred Correction (IDC). One difference between SDC and IDC is that, in IDC, we are able to use high order single step methods in the correction loop. We have formally established that, under key assumptions, if an r^{th} order single step method is used in the correction loop of IDC, the order of IDC increases by r with each correction loop, for both explicit and implicit IDC, up to a maximum order M. Further, it has been observed that when a high order method is used in the correction step of explicit IDC, dramatically improved regains of absolute stability are observed. We have applied this class of methods to a range of stiff and non stiff test problems and we are currently working on applying this adaptive approach to fully Lagrangian plasma simulations. (Received February 10, 2009)