A class of implicit peer methods

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We present a class of s-stage implicit two step peer methods for the solution of stiff differential equations using in addition also the function values from the previous step. This allows to increase the order to $p = s$. Corresponding s-stage methods for $s \leq 5$ of order $p = s$ with optimal zero stability are presented. Numerical tests and comparison with ode15s show the high potential of this class of implicit peer methods. Under special conditions, we prove that an optimally zero-stable subclass of these methods is superconvergent of order $p = s + 1$.