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We study Tikhonov regularization for ill-posed non-linear operator equations in Hilbert scales. Our focus is on the interplay between the smoothness-promoting properties of the penalty and the smoothness inherent in the solution. The objective is to study the situation when the unknown solution fails to have a finite penalty value, hence when the penalty is oversmoothing. By now this case was only studied for linear operator equations in Hilbert scales. We extend those results to certain classes of non-linear problems. The main result asserts that, under appropriate assumptions, order optimal reconstruction is still possible. Finally, we highlight that the non-linearity assumption underlying the present analysis is met for specific applications.

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