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On generalized definitions of ultradifferentiable and ultraholomorphic classes

In the past decade and simultaneously, two ways to generalize Denjoy-Carleman ultradifferentiable classes have appeared. We show that the ultradifferentiable-like classes of smooth functions introduced and studied by S. Pilipović, N. Teofanov and F. Tomić are special cases of the general framework of ultradifferentiable (and ultraholomorphic) spaces of functions defined in terms of weight matrices in the sense of A. Rainer and G. Schindl. We study classes "beyond geometric growth factors" defined in terms of a weight sequence and an exponent sequence and we prove that these new types admit a weight matrix representation. Thanks to this representation, we can transfer known results from one context to another, which will allow us to address the concepts of asymptotic expansion and summability in a natural way.