

On the Trail of Vujičić's Coordinates-Independent Position Vector Formulation: Problematizing and Correcting Traditional Divergence and Laplacian Operators

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Abstract. In [1], where the main topic was (re-)affirmation of Vujičić's coordinates-independent formulation of a material point position vector formulation and derivation of the expressions for the tangential and normal accelerations with only second order of the polar coordinates, the problem of the inappropriateness of the traditional Divergence (and thus the Laplacian) operator(s) has been hinted, as the repercussion of the position vector representation through only the radial basis vector component. It has been indicated that the traditional formulation of the divergence operator might be inadequate for the situation where the radial symmetry is absent and the particular example of the related issue cited [2]. In this contribution this topic will be further elaborated and the comparison between the traditional and the rotationally-invariant/classically-covariant spatial derivatives in polar coordinates evaluated for the examples dealt with in [3]. While primarily the Divergence and its extension in the form of Laplacian operator will be treated, along the Gradient one, the appropriateness of traditional 'transformation' of a scalar function will be re-examined, whereby additional support will be sought for in [4].

Keywords: Differential Geometry; Spatial Derivatives; Transformation of Coordinates.

References

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