

Zbl pre05323529

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Parametrization and stress-energy-momentum tensors in metric field theories. (English)

J. Phys. A, Math. Theor. 41, No. 34, Article ID 344002, 10 p. (2008). ISSN 1751-8113; ISSN 1751-8121

<http://dx.doi.org/10.1088/1751-8113/41/34/344002>

<http://www.iop.org/EJ/journal/1751-8121>

Summary: We give an exposition of the 1972 parametrization method of Kuchař in the context of the multisymplectic approach to field theory. The purpose of the formalism developed here is to make any classical field theory, containing a metric as a sole background field, generally covariant (that is, parametrized, with the spacetime diffeomorphism group as a symmetry group) as well as fully dynamic. This is accomplished by introducing certain 'covariance fields' as genuine dynamic fields. As we shall see, the multimomenta conjugate to these new fields form the Piola-Kirchhoff version of the stress-energy-momentum tensor field, and their Euler-Lagrange equations are vacuously satisfied. Thus, these fields have no additional physical content; they serve only to provide an efficient means of parametrizing the theory. Our results are illustrated with two examples, namely an electromagnetic field and a Klein-Gordon vector field, both on a background spacetime.

Classification :

*70S99 None of the above, but in this section