Symmetry of Brans-Dicke gravity as a novel solution-generating technique

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We present a symmetry of Brans-Dicke gravity in (electro-)vacuo or with conformally invariant matter and use it as a solution-generating technique within this theory. This technique uses known solutions of the scalar-tensor field equations as seeds and generates new solutions of the field equations. The symmetry of the Brans-Dicke action and field equations consists of a conformal transformation of the metric (with an appropriate power of the scalar field as conformal factor), plus a non-linear rescaling of the Brans-Dicke scalar field. Using this novel general technique, we generate a new 3-parameter family of spherical, time-dependent, space-times conformal to a Campanelli-Lousto geometry, plus a family of cylindrically symmetric geometries. Even in spherical symmetry, time-dependent analytic solutions of scalar-tensor gravity are rather rare and the new family found adds to the meagre catalogue.

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