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The $k$-almost Yamabe solitons and contact metric manifolds. (English) [Zbl 07393756]
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Summary: We introduce the concept of a $k$-almost Yamabe soliton which extends naturally from Yamabe solitons. Our aim is to study the $k$-almost Yamabe soliton $(g, V, k, \lambda)$ on a contact metric manifold $M^{2n+1}$. Firstly, for a general contact metric manifold, it is proved that $V$ is Killing if the potential vector field $V$ is a contact vector field and that $M$ is $K$-contact if $V$ is collinear with Reeb vector field. Secondly, we prove that a compact $K$-contact manifold, admitting a $k$-almost Yamabe gradient soliton, is isometric to a standard unit sphere. Moreover, for a complete Sasakian manifold admitting a $k$-almost Yamabe soliton, we show that it is isometric to a standard unit sphere $\mathbb{S}^{2n+1}(1)$ when $n > 1$ and for $n = 1$, $M$ is also isometric to a standard unit sphere if it admits a closed $k$-almost Yamabe soliton. Finally, we consider a contact metric $(\kappa, \mu)$-manifold with a nontrivial $k$-almost Yamabe gradient soliton and show that it is flat in dimension 3 and in higher dimension $M$ is locally isometric to $E^{n+1}\times \mathbb{S}^n(4)$. In the end, we construct two examples of contact metric manifolds with a $k$-almost Yamabe soliton.

MSC:
53D10 Contact manifolds (general theory)
53D25 Geodesic flows in symplectic geometry and contact geometry
53C25 Special Riemannian manifolds (Einstein, Sasakian, etc.)

Keywords:
k-almost Yamabe soliton; $K$-contact manifold; Sasakian manifold; contact metric $(\kappa; \mu)$-manifold

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References:


