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The Liouville Theorem of a Torsion System and its Application to the Symmetry Group of a Porous Medium Type Equation on Symmetric Spaces

We first prove a Liouville theorem to the torsion system

$$
\begin{cases}
\xi_i^i = \lambda(x) \pm \dfrac{2x^k \xi^k}{|x|^2 + 1}, & \forall i = 1, 2, \cdots, n \\
\xi_j^i + \xi_i^j = 0, & \forall i \neq j
\end{cases}
$$

for $(\xi, \lambda) \in C^\infty(\mathbb{R}^n, \mathbb{R}^n \times \mathbb{R})$. As an application, complete resolutions of symmetry groups to the porous medium equation

$$
u_t - \triangle_g(u^m) = u^p, \quad \forall (x, t) \in M \times \mathbb{R}
$$

of Fujita type are obtained, where M is the sphere $\mathbb{S}^n \subset \mathbb{R}^{n+1}$ or hyperbolic space $\mathbb{H}^n$ with canonical metric g.

Keywords: Porous medium equation, prolongation formula.

MSC: 53C35, 35K59, 35K65.