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Title: On the set of harmonic solutions of a class of perturbed coupled differential equations

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Abstract: In this talk we present recent results jointly obtained with Marco Spadini (University of Florence). We study the set of T-periodic solutions of a class of T-periodically perturbed coupled differential equations on manifolds. More precisely, let $M \subseteq \mathbb{R}^k$ be a boundaryless smooth manifold. Given $T > 0$, we consider T-periodic solutions to the following system of equations

$$\begin{cases} \dot{x} = A(t)x + c(t) + \lambda f_1(t,x,y), \ \lambda \geq 0 \\ \dot{y} = \lambda f_2(t,x,y), \end{cases} \tag{1}$$

where $A : \mathbb{R} \to GL(\mathbb{R}^n) \subseteq \mathbb{R}^{n\times n}$ is a continuous matrix-valued map, $c : \mathbb{R} \to \mathbb{R}^n$ is a sufficiently regular vector-valued map, $\mathbf{f} := (f_1, f_2)$ is continuous with $f_1 : \mathbb{R}\times(\mathbb{R}^n \times M) \to \mathbb{R}^n$ and $f_2 : \mathbb{R} \times (\mathbb{R}^n \times M) \to \mathbb{R}^k$ and, in particular, f_2 is a tangent vector field to M, in the sense that for every $(t, p, q) \in \mathbb{R} \times (\mathbb{R}^n \times M)$ it holds that $f_2(t, p, q) \in T_qM$. Moreover, all of these maps are assumed to be T-periodic, $T > 0$ given, with respect to the t-variable.

The main novelty of this study is related to the fact that we consider the case of T-periodic perturbations of nonautonomous coupled differential equations on $\mathbb{R}^n \times M$.

By applying degree-theoretic methods we obtain a global continuation result for the T-periodic solutions of (1). Hence, we provide sufficient conditions for the existence of branches of T-periodic solutions.