An analysis of the reduced thin-sandwich equations

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The reduced thin-sandwich equations (RTSE) appear within J. Wheeler's proposal of solving the constraint equations of general relativity in terms of the *lapse function* and *shift vector field*. When these equations are well-posed, it is possible to follow this program and solve the constraints in terms of these *gauge* variables. Nevertheless, it has been shown that generically this program cannot work [1]. Sufficient conditions for the existence of solutions of the RTSE on compact 3-dimensional manifolds were first established in [2].

During this talk, the proposal is to present the results established in [3], where the main theorem shown in [2] is extended to any dimension $n \geq 3$, and, furthermore, it is shown that on any compact n-dimensional manifold, $n \geq 3$, there is an open subset in the space of solutions of the constraint equations where the *thin-sandwich problem* is well-posed. The proof of this last result relies on some interesting and well-known theorems in geometric analysis [4]-[5], which enable us to guarantee the existence of appropriate *reference solutions* of the constraint equations.

Finally, we will show analogous results to the ones presented in [3] outside the compact setting, namely, for manifolds which are euclidean at infinity, and, furthermore, discuss how, in the compact setting, the above mentioned results can be refined when we analyse the thin-sandwich equations around solutions where the main results presented in [3] are not applicable.

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