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Hirzebruch's signature theorem

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Abstract.
Hirzebruch's signature theorem is a powerful theorem in differential geometry. It relates the signature, a bordism invariant essential to understand smooth manifolds in dimensions multiple of four, so in particular the important case of four itself, to Pontrjagin numbers, which are obtained from Pontrjagin classes, so characteristic classes used to classify vector bundles. Hirzebruch's signature theorem stands behind many more powerful applications: In four dimensions, the signature is a complete oriented bordism invariant, meaning that two orientable 4-manifolds can be connected by an orientable 5-manifold if and only if their signatures are identical. In eight dimensions, Milnor's exotic 7-spheres were shown to have the essential property of being homeomorphic and not diffeomorphic by using Hirzebruch's signature theorem. In twelve dimensions, the signature is used in advanced branches of string theory like the $10+2$-dimensional F-theory.