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Characteristic classes and transversality

Let ξ be a smooth vector bundle over a differentiable manifold M. Let $h\colon \varepsilon^{n-i+1} \to \xi$ be a generic bundle morphism from the trivial bundle of rank $n-i+1$ to ξ. We give a geometric construction of the Stiefel–Whitney classes when ξ is a real vector bundle, and of the Chern classes when ξ is a complex vector bundle. Using h we define a differentiable closed manifold $\tilde{Z}(h)$ and a map $\phi\colon \tilde{Z}(h) \to M$ whose image is the singular set of h. The i-th characteristic class of ξ is the Poincaré dual of the image, under the homomorphism induced in homology by ϕ, of the fundamental class of the manifold $\tilde{Z}(h)$. We extend this definition for vector bundles over a paracompact space, using that the universal bundle is filtered by smooth vector bundles.