A characterization of compact operators via the non-connectedness of the attractors of a family of IFSs

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In this paper we present a result which establishes a connection between the theory of compact operators and the theory of iterated function systems. For a Banach space X, S and T bounded linear operators from X to X such that \parallel S \parallel, \parallel T \parallel <1 and w \in X, let us consider the IFS S_{w}=(X,f_1,f_2), where f_1,f_2:X \rightarrow X are given by f_1(x)=S(x) and f_2(x)=T(x)+w, for all x \in X. On one hand we prove that if the operator S is compact, then there exists a family (K_{n})_{n \in N} of compact subsets of X such that A_{S_{w}} is not connected, for all w \in H- \cup K_{n}. One the other hand we prove that if H is an infinite dimensional Hilbert space, then a bounded linear operator S:H \rightarrow H having the property that \parallel S \parallel <1 is compact provided that for every bounded linear operator T:H\rightarrow H such that \parallel T \parallel <1 there exists a sequence (K_{T,n})_{n} of compact subsets of H such that A_{S_{w}} is not connected for all w \in H- \cup K_{T,n}. Consequently, given an infinite dimensional Hilbert space H, there exists a complete characterization of the compactness of an operator S:H \rightarrow H by means of the non-connectedness of the attractors of a family of IFSs related to the given operator.

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