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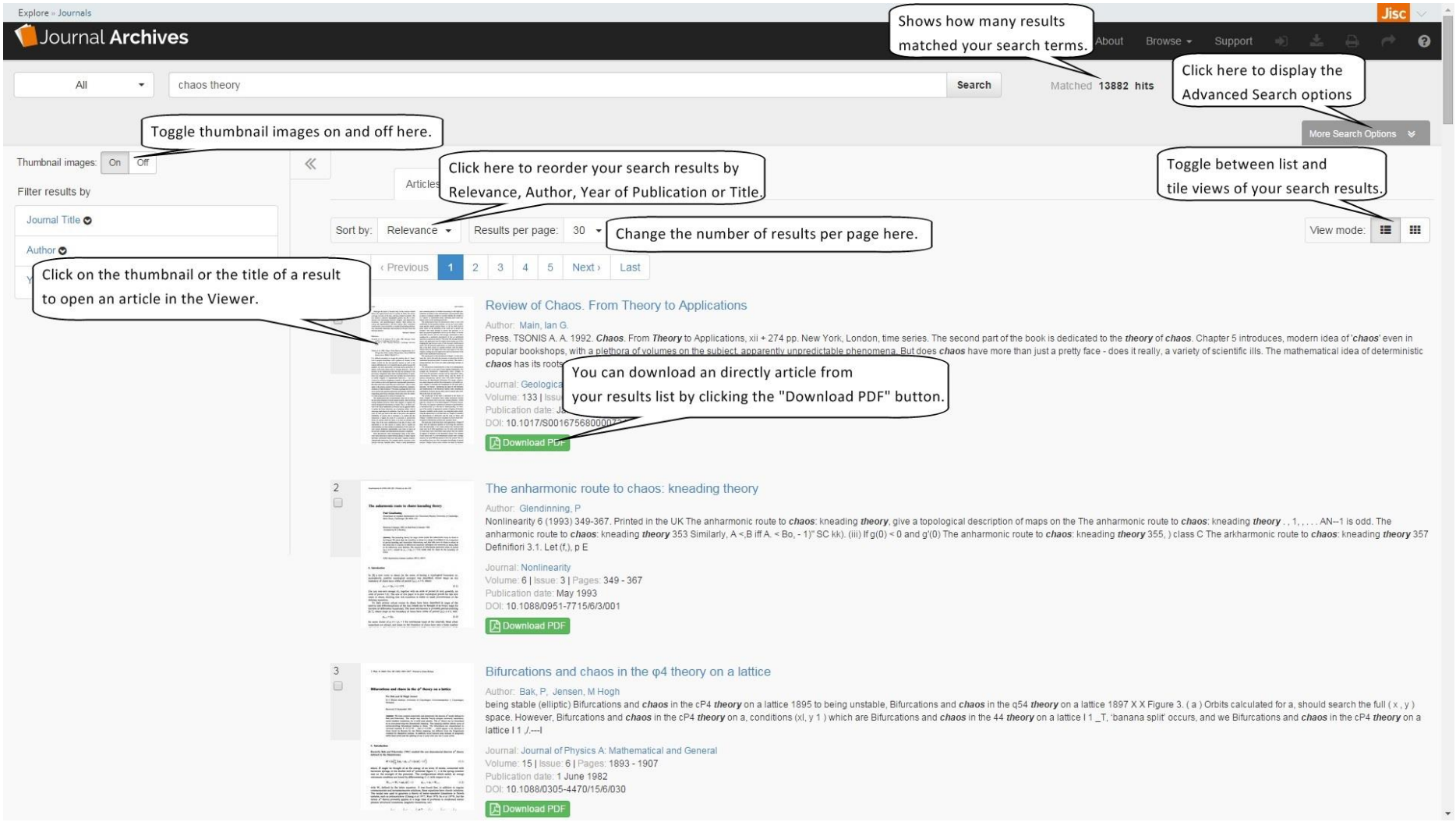
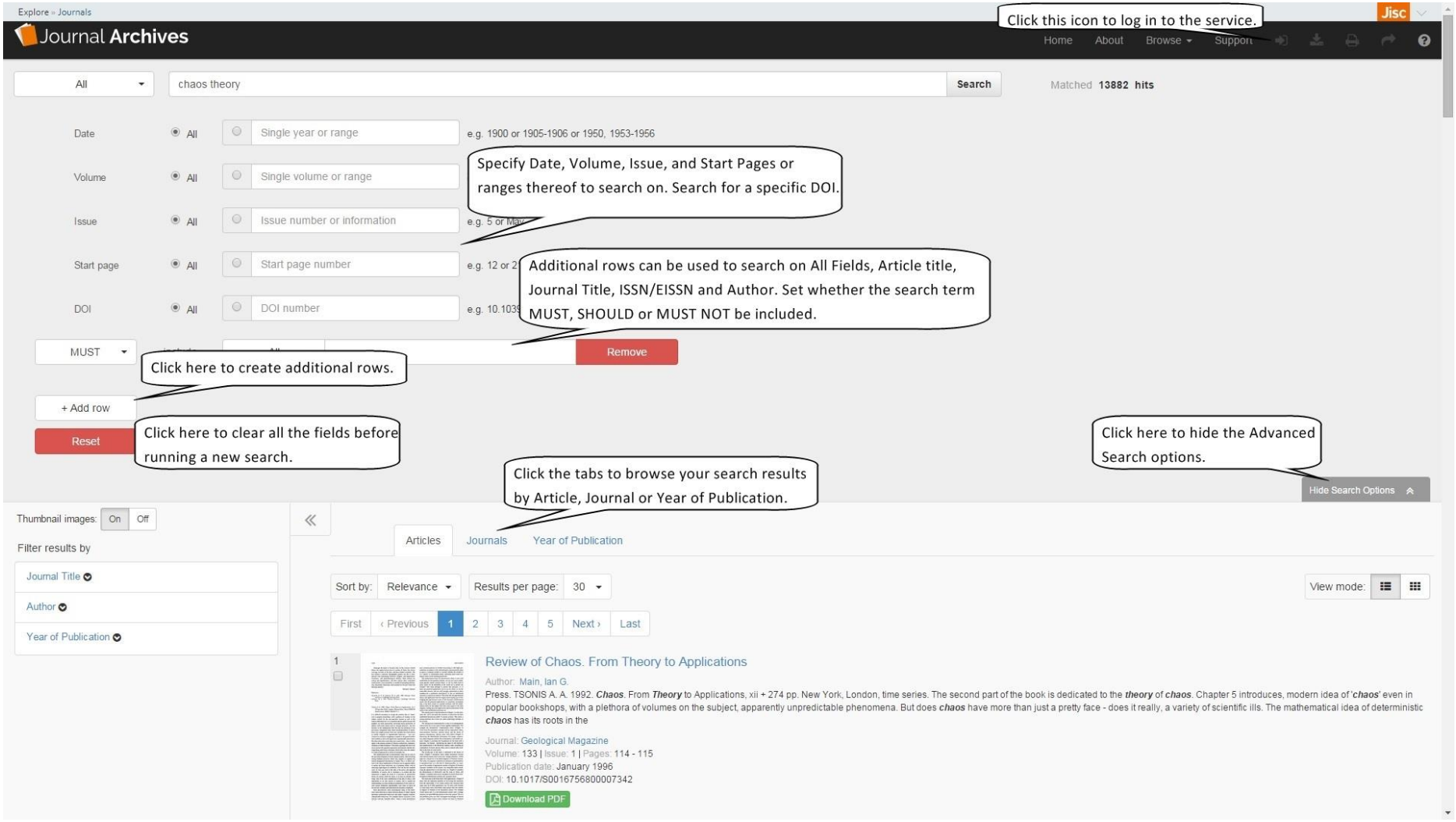
Updated by Paul Flieshman, 10/02/15

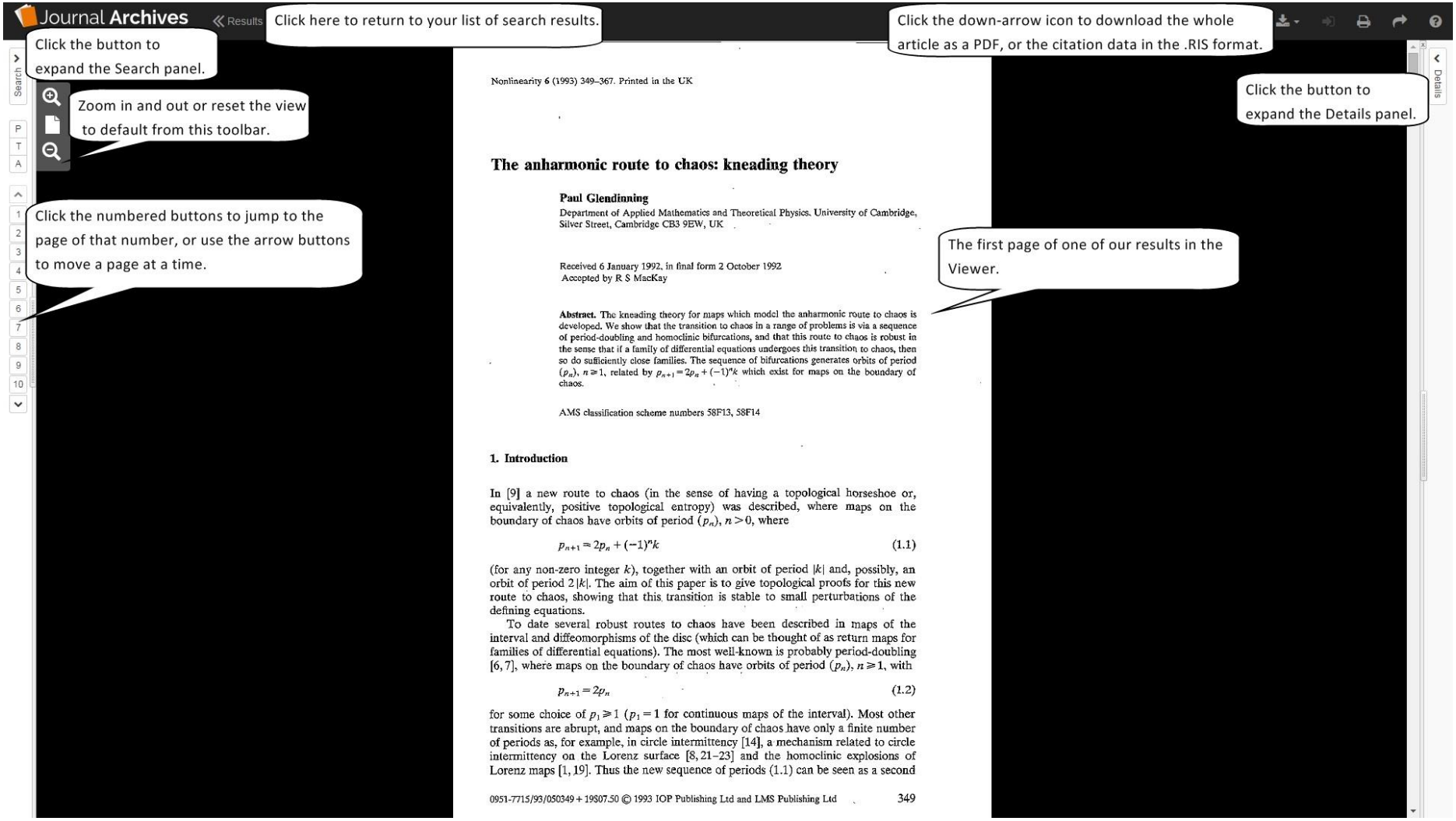
Search View, with results shown below



Search View, expanded to show Advanced Options



Using the Viewer to look at a document



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The anharmonic route to chaos: kneading theory

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Abstract. The kneading theory for maps which model the anharmonic route to chaos is developed. We show that the transition to chaos in a range of problems is via a sequence of period-doubling and homoclinic bifurcations, and that this route to chaos is robust in the sense that if a family of differential equations undergoes this transition to chaos, then so do sufficiently close families. The sequence of bifurcations generates orbits of period (p_n), $n \geq 1$, related by $p_{n+1} = 2p_n + (-1)^n k$ which exist for maps on the boundary of chaos.

AMS classification scheme numbers 58F13, 58F14

1. Introduction

In [9] a new route to chaos (in the sense of having a topological horseshoe or, equivalently, positive topological entropy) was described, where maps on the boundary of chaos have orbits of period (p_n), $n > 0$, where

$$p_{n+1} = 2p_n + (-1)^n k \tag{1.1}$$

(for any non-zero integer k), together with an orbit of period $|k|$ and, possibly, an orbit of period $2|k|$. The aim of this paper is to give topological proofs for this new route to chaos, showing that this transition is stable to small perturbations of the defining equations.

To date several robust routes to chaos have been described in maps of the interval and diffeomorphisms of the disc (which can be thought of as return maps for families of differential equations). The most well-known is probably period-doubling [6, 7], where maps on the boundary of chaos have orbits of period (p_n), $n \geq 1$, with

$$p_{n+1} = 2p_n \tag{1.2}$$

for some choice of $p_1 \geq 1$ ($p_1 = 1$ for continuous maps of the interval). Most other transitions are abrupt, and maps on the boundary of chaos have only a finite number of periods as, for example, in circle intermittency [14], a mechanism related to circle intermittency on the Lorenz surface [8, 21–23] and the homoclinic explosions of Lorenz maps [1, 19]. Thus the new sequence of periods (1.1) can be seen as a second

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The Viewer, with the Search and Details panels open