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KINEMATICS OF NETWORK FLOW: FORECASTING THE EMERGENCE OF HOTSPOTS

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Abstract. User-attention has become a "new currency of business". In certain online enterprises, for example, the set of key performance indicators now includes user-engagement metrics. This leads us to a question of considerable financial significance: can we predict an imminent surge in the flow of user-attention towards an enterprise, before the surge starts? Previous investigators considered the details of inter-user interactions to understand the mechanisms that drive online communities. Here, we regard user-attention as a fluid that flows among enterprises and accumulates in them. By allowing the enterprises to compete for the available user-attention, we then establish detectable sufficient conditions that, when met, signal an imminent parabolic (accelerated) surge in the amount of user-attention flowing towards an enterprise. Our result shows that, at least in our simple model, it is possible to predict an imminent surge in the attention-flow towards an enterprise by merely tracking the historic attention-flow.

Keywords. non-linearity, dynamic systems, difference equations, n-body systems, criticality

AMS (MOS) subject classification: 39A60, 37N99

1 Introduction

Popularity has become a "new currency of business". In websites, for example, the set of key performance indicators now includes user-engagement metrics in addition to the traditional financial metrics, such as earnings. The increasing importance of popularity (user-attention) in the valuation and growth of online enterprises, raises a question of considerable financial significance: can we predict an imminent surge in the flow of user-attention towards an enterprise, before the surge starts?

For the rest of the paper we will refer to popularity by a more definable and quantifiable term, *user-attention*. Since popularity on the World Wide Web is essentially user-engagement driven, it is logical to use some measure of users' attention as a metric to gauge popularity of websites. In analogy with the widely used term *cash position*, which describes the financial reserves of an enterprise, we use the term *attention position* to describe the amount of user-attention vested in a website.