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Citation Trend of Indian Physics and Astronomy Research during 2005-2020 through the Lens of Some New Indicators

Gopinath Das[#], Bidyarthi Dutta[$,*] and Anup Kumar Das[!]

[#]*Santal Bidroha Sardha Satabarshiki Mahavidyalaya, Goaltore, Paschim Medinipur - 721 128, India*
[$]*Vidyasagar University, Midnapore - 721 102, India*
[!]*Jawaharlal Nehru University, Delhi - 110 067, India*
[*]*E-mail: bidyarthi.bhaswati@gmail.com*

ABSTRACT

The indicator Citation Swing Factor (CSF) has recently been developed to quantitatively measure the diffusion process from h-core zone to h-core excess zone. This paper calculated CSF for Indian physics and astronomy research output appeared in selective Indian journals since 2005 to 2020. The theoretical values of CSF are also calculated on the basis of its fundamental equation and same was compared it with the respective observed values. The average error over entire time span is found 2.26 per cent indicating close proximity between theoretically expected and practically observed values. Besides, three other scientometric indicators are introduced here, viz. Time-Normalised Total Cited Ratio (TC), Time-Normalised Cited Uncited Ratio (CU) and Time-Normalised Total Uncited Ratio (TU). Of these four indicators, the variation of TC is highest (1.76), followed by TU (0.53), CU (0.37) and CSF(E) (0.09), as evident from the values of respective Coefficients of Variations. The numerical values of these indicators are found out for the same sample and the temporal variations along with their mutual interrelationships are determined by regression analysis. It is observed that the three indicators, TC, CU and TU are mutually interrelated through the following linear regression equations, i.e. $TC = -0.76 + 1.88*TU$ and $CU = -0.201 + 0.34*TU$.

Keywords: H-Index; Excess citation; e Index; R Index; Total citation; h-core citation; Citation diffusion; Citation swing factor; Cited to uncited ratio

1. INTRODUCTION

The term 'Citation' implies a connection between a part or whole of the cited document and a part or whole of the citing document, broadly known as source document[1]. A 'Reference' is the acknowledgement that one document gives to another and a 'Citation' is the acknowledgement that one document receives from another[2]. According to Garfield[3], there are many reasons behind the existence of citation. The citation analysis is the most popular technique used in scientometrics that helps in evaluating the quality of research publications, assessing the contribution of authors and standard of journals. Eugene Garfield[4-8] illustrated in several articles the potentialities of citation analysis in the evaluation of research faculty. According to Price[9], citation patterns in research articles indicate the research front in a particular subject domain. The citation is a recognition of intellectual works that is reckoned as principal rewards of science[10]. This paper has verified the observed values of a recently introduced indicator, viz. Citation Swing Factor, with its formula-based theoretically calculated values for a sample of Scopus-indexed 18357 Indian physics and astronomy research publications from 2005 to 2020, which received 91245 citations. Besides, this paper proposed three citation-based indicators, calculated their values for the same sample and determined the inter-relationship among them.

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2. LITERATURE REVIEW

Citation trend analysis includes the study of changing number of citations received by articles or journals over the years. Usually, the articles or journals of a particular discipline or subject are studied in this context. The citation trends of journals devoted to subjects like primatology[11], psychological medicine[12], forensic science[13] and behavioural psychology[14] were analysed. The citation trend analysis of physical therapy research output was done by Imai[15] et al. Morgan[16] investigated whether citation trends reflect epidemiologic patterns. Gazni[17] analysed journal self-citation trends and Ajibade & Stephen[18] analysed citation trends on E-government in South African countries. Giovanni[19], Biradar & Kumbar[20], Chi[21] and Singh[22] analysed citation trends on psychiatry, environmental science, political science and defense science respectively. The bibliometric indicators developed before 2k evaluated Journals on the basis of citation count and number of papers. The concept of author-level indicators and article-level indicators were developed after 2k. The introduction of h index by Hirsch[23] in 2005 was the milestone of modern or post-2k metrics. A scientist has h-index equal to H if the top H of his/her N publications from a ranked list have at least H citations