

## Errors in DOI indexing by bibliometric databases

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**Abstract** DOI—i.e., Digital Object Identifier—is a character string, which univocally identifies entities that are object of intellectual property. In bibliometrics, DOIs are used for univocally identifying scientific papers. The aim of this short communication is to raise the reader’s awareness of bibliometric database errors in DOI indexing, in particular, the incorrect assignment of a single DOI to multiple papers. This error is quite interesting since DOI is commonly regarded as an effective means to identify scientific articles unambiguously. For the purpose of example, a short list of DOIs, which have been wrongly assigned by the Scopus database to multiple papers, is shown. Although being relatively rare, DOI indexing errors should be considered by bibliometricians when querying bibliometric databases by DOI.

**Keywords** Database errors · Citation analysis · DOI indexing error · Multiple DOI assignment · Scopus

### Introduction

Bibliometric databases—e.g., Scopus and Web of Science (WoS)—are affected by different types of errors, which may impact on citation statistics. Over the past decade, the accuracy of bibliometric databases has improved significantly, probably due to the methodical use of (semi) automatic tools for correcting errors in cited article lists by editors and database administrators (Adam 2002). However, the problem is far from being solved, as proven by the fact that bibliometric database staff constantly encourage users to report any noticed inaccuracy.

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**Table 1** Classification of bibliometric database errors according to (Buchanan 2006)

Error type	Author errors	Database mapping errors
Definition	Errors made by authors when creating the list of cited articles for their publication	Failure to establish an electronic link between a cited article and the corresponding citing articles that can be attributed to a data-entry error
Examples	Errors in name and initials of the first author	Transcription errors
	Errors in publication title	Target-source article record errors
	Errors in publication year	Cited article omitted from a cited-article list
	Errors in volume number Errors in pagination	Reason unknown

Several recent articles document the existence of database errors of different nature (Jacso 2006, 2012; Franceschini et al. 2013, 2014); a synthetic taxonomy of the major errors is reported in Table 1, distinguishing between author and database mapping errors (Buchanan 2006).

While author errors are generally due to lack of care of authors when creating the cited article lists, database mapping errors may originate from poor or imperfect communication between database administrators (i.e., data receivers) and editors (i.e., data providers). In fact, the administrators' requirement to quickly update bibliometric databases, whenever new data are available from editors, may sometimes conflict with indexing accuracy.

### Multiple DOI assignment

In a relatively recent paper (Franceschini et al. 2014), we analyzed a set of journals indexed by Scopus and WoS, in order to estimate the rate of omitted citations, i.e., missing links between a cited paper and the corresponding citing papers. Precisely, we examined the citations indexed by Scopus and WoS, focusing on those received from journals purportedly indexed by both databases, and we showed that the citations obtained from some publishers are more likely to be omitted than those from other ones, for several reasons. The dataset included more than 27,000 articles of interest, published by 34 different journals in the field of manufacturing engineering field, with more than 112,000 citing papers issued in the time-window from 2006 to 2012.

A curious outcome of the analysis, which has not been explained in our previous paper (Franceschini et al. 2014), is the fact that bibliometric databases may sometimes mistakenly assign the same digital object identifier (DOI) to multiple papers. We recall that DOI is a character string used to univocally identify entities that are object of intellectual property (Paskin 2002). Each DOI is by definition unique and must identify one and only one entity. Since several years, DOIs are used in bibliometrics for identifying and disambiguating scientific papers. Obviously, errors in the DOI character string could distort the results of bibliometric analyses, in the case DOI is used for querying bibliometric databases.

**Table 2** List of DOIs mistakenly assigned to multiple articles by the Scopus database

DOI	Corresponding articles	
(i) <a href="https://doi.org/10.1016/j.jmatprotec.2005.11.008">10.1016/j.jmatprotec.2005.11.008</a>	(1) Costa, P. J. M. S., R. Q. B. Vilela, R. Cipolotti and M. S. Figueiredo (2006). "Clinical and laboratorial diversity in the bantu haplotype of sickle cell anemia." <i>Revista Brasileira de Hematologia e Hemoterapia</i> 28(1): 40–44	✗
(vi) <a href="https://doi.org/10.1016/j.jmatprotec.2005.11.033">10.1016/j.jmatprotec.2005.11.033</a>	(2) Costa, T. H. C., M. C. Feitor, C. Alves Jr, P. B. Freire and C. M. De Bezerra (2006). "Effects of gas composition during plasma modification of polyester fabrics." <i>Journal of Materials Processing Technology</i> 173(1): 40–43	✓
(ii) <a href="https://doi.org/10.1016/j.jmatprotec.2005.11.037">10.1016/j.jmatprotec.2005.11.037</a>	(1) Pan, W. (2006). "Incorporating gene functional annotations in detecting differential gene expression." <i>Journal of the Royal Statistical Society. Series C: Applied Statistics</i> 55(3): 301–316	✗
(iii) <a href="https://doi.org/10.1016/j.jmatprotec.2005.11.037">10.1016/j.jmatprotec.2005.11.037</a>	(2) Pan, Z., H. Zhang, Z. Zhu and J. Wang (2006). "Chatter analysis of robotic machining process." <i>Journal of Materials Processing Technology</i> 173(3): 301–309	✓
(iv) <a href="https://doi.org/10.1007/s00170-004-1884-2">10.1007/s00170-004-1884-2</a>	(1) Bao, G., K. Shinozaki, S. Iguro, M. Inkyo, M. Yamamoto, Y. Mahara and H. Watanabe (2006). "Stress corrosion cracking sealing in overlaying of Inconel 182 by laser surface melting." <i>Journal of Materials Processing Technology</i> 173(3): 330–336	✓
(v) <a href="https://doi.org/10.1007/s00170-004-2324-z">10.1007/s00170-004-2324-z</a>	(2) Bao, L. and M. C. Trachtenberg (2006). "Facilitated transport of CO2 across a liquid membrane: Comparing enzyme, amine, and alkaline." <i>Journal of Membrane Science</i> 280(1–2): 330–334	✗
(vi) <a href="https://doi.org/10.1016/j.ijmachtools.2005.08.006">10.1016/j.ijmachtools.2005.08.006</a>	(1) Hu, J., L. Xiao, Y. Wang and Z. Wu (2006). "An optimal feedrate model and solution algorithm for a high-speed machine of small line blocks with look-ahead." <i>International Journal of Advanced Manufacturing Technology</i> 28(9): 930–935	✓
(vii) <a href="https://doi.org/10.1016/j.rcim.2005.02.007">10.1016/j.rcim.2005.02.007</a>	(2) Hu, M. C. (2006). "Erratum: Steroid deficiency syndromes in mice with targeted disruption of Cyp11a1 (Molecular Endocrinology (2000) 16 (1943–1950))." <i>Molecular Endocrinology</i> 20(4): 930	✗
	(1) Wu, D. (2006). "Detecting information technology impact on firm performance using DEA and decision tree." <i>International Journal of Information Technology and Management</i> 5(2–3): 162–174	✗
	(2) Wu, X., J. Chen, R. Li and F. Li (2006). "Web-based remote monitoring and fault diagnosis system." <i>International Journal of Advanced Manufacturing Technology</i> 28(1–2): 162–175	✓
	(1) Lee, C. Z., J. S. Yao, Y. Huang, W. Zhai, W. Liu, B. J. Guglielmo, E. Lin, G. Y. Yang and W. L. Young (2006). "Dose-response effect of tetracyclines on cerebral matrix metalloproteinase-9 after vascular endothelial growth factor hyperstimulation." <i>Journal of Cerebral Blood Flow and Metabolism</i> 26(9): 1157–1164	✗
	(2) Lee, R. T., Y. C. Hwang and Y. C. Chiou (2006). "Lapping of ultra-precision ball surfaces. Part II. Eccentric V-groove lapping system." <i>International Journal of Machine Tools and Manufacture</i> 46(10): 1157–1169	✓
	(1) Zhao, J. S., Y. Z. Fu, K. Zhou and Z. J. Feng (2006). "Mobility properties of a Schoenflies-type parallel manipulator." <i>Robotics and Computer-Integrated Manufacturing</i> 22(2): 124–133	✓
	(2) Zhao, Y., X. Luo, Y. Ming, L. Chen and Y. Li (2006). "Rapid separation and determination of resibufogenin and cimobufagin in toad venom and Liushen tablet by $\beta$ -cyclodextrin modified micellar electrokinetic chromatography." <i>Journal of Pharmaceutical and Biomedical Analysis</i> 41(1): 124–128	✗

Table 2 continued

DOI	Corresponding articles	
(viii) <a href="https://doi.org/10.3401/poms">10.3401/poms</a>	(1) Aksin, Z., M. Armony and V. Mehrotra (2007). "The modern call center: A multi-disciplinary perspective on operations management research." <i>Production and Operations Management</i> 16(6): 665–688	✗
	(2) Bardhan, I., S. Mithas and S. Lin (2007). "Performance impacts of strategy, information technology applications, and business process outsourcing in U.S. manufacturing plants." <i>Production and Operations Management</i> 16(6): 747–762	✗
	(3) Gupta, D. (2007). "Surgical suites' operations management." <i>Production and Operations Management</i> 16(6): 689–700	✗
	(4) Queenan, C. C., M. Ferguson, J. Higbie and R. Kapoor (2007). "A comparison of unconstraining methods to improve revenue management systems." <i>Production and Operations Management</i> 16(6): 729–746	✗
	(5) Shanthikumar, J. G. and D. D. Yao (2007). "John A. Buzacott and his pioneering contributions to manufacturing and service systems." <i>Production and Operations Management</i> 16(6): 657–664	✗
	(6) Shen, Z. J. M. and X. Su (2007). "Customer behavior modeling in revenue management and auctions: A review and New Research Opportunities." <i>Production and Operations Management</i> 16(6): 713–728	✗
	(7) Smith, J. S., K. R. Karwan and R. E. Markland (2007). "A note on the growth of research in service operations management." <i>Production and Operations Management</i> 16(6): 780–790	✗
	(8) Subramanian, R., S. Gupta and B. Talbot (2007). "Compliance strategies under permits for emissions." <i>Production and Operations Management</i> 16(6): 763–779	✗
	(9) Xia, C. H. and P. Dube (2007). "Dynamic pricing in e-services under Demand Uncertainty." <i>Production and Operations Management</i> 16(6): 701–712	✗

Symbols "✓" and "✗" respectively denote the correct and incorrect DOI assignment. It is worth noting that the last DOI (viii), which is probably incomplete, is mistakenly assigned to the totality of the nine papers returned by Scopus

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<input type="checkbox"/>	Effects of gas composition during plasma modification of polyester fabrics	Costa, T.H.C., Fellor, M.C., Alves Jr. C., Freire, F.B., De Bezerra, C.M.	2006	Journal of Materials Processing Technology	30	

Display  results per page

**Author Name**

- Alves, C. (1)
- Cipolotti, R. (1)
- Costa, P.J.M.S. (1)
- Costa, T.H.C. (1)
- De Bezerra, C.M. (1)

**Year**

- 2006 (2)

Fig. 1 Example of Scopus query, returning two papers mistakenly associated with the same DOI (in the top left-hand side)

Returning to the previous discussion, Table 2 shows an example of multiple DOI assignments by the Scopus database, in which each of the eight DOIs reported (i.e., i–viii) is mistakenly assigned to two or more different articles. For the purpose of example, Fig. 1 shows the screenshot of the Scopus database response, relating to the first DOI.

It is worth remarking that the errors in Table 2 represent only a subset of those found in our analysis. Also, these errors have been detected few weeks before the submission of this short communication and they might be corrected by the database in the next future.

## Final remarks

This short communication reported the existence of bibliometric database errors concerning DOI indexing. These errors are quite interesting since the DOI to a scientific paper is like the “ID card” to a person and is commonly regarded as an effective means of disambiguation. The most surprising manifestation of these errors is represented by multiple DOI assignment. Although probably being rather unusual (according to a preliminary estimation, the error rate in the Scopus database is of the order of magnitude of 1/1,000), the fact remains that this error type could potentially influence the results of bibliometric analyses.

Future research will go into the multiple DOI assignment issue in more detail, investigating the practical reasons behind this error and providing a more accurate estimation of the error rate, for both Scopus and WoS.

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