

RESEARCH ON DIGITAL STANDARD FORM AND MODEL OF AVIATION MANUFACTURING INDUSTRY

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AVIC CHINA AERO-POLYTECHNOLOGY ESTABLISHMENT



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1. INTRODUCTION

The current standards are mainly in the form of texts. With the development and application of aviation digital and intelligent manufacturing technologies, requirements that standards can be directly identified and used by machines are increasing.

Digital standard is a new standard form which adapts to digital environment.

Mainly including two aspects:

- **Special digital standard**-The special digital standard mainly solves the digitization problem of the standard itself.
- **General digital standard**- General digital standard refers to how standard is applied to the process of digital development and production.



2. SITUATION ANALYSIS

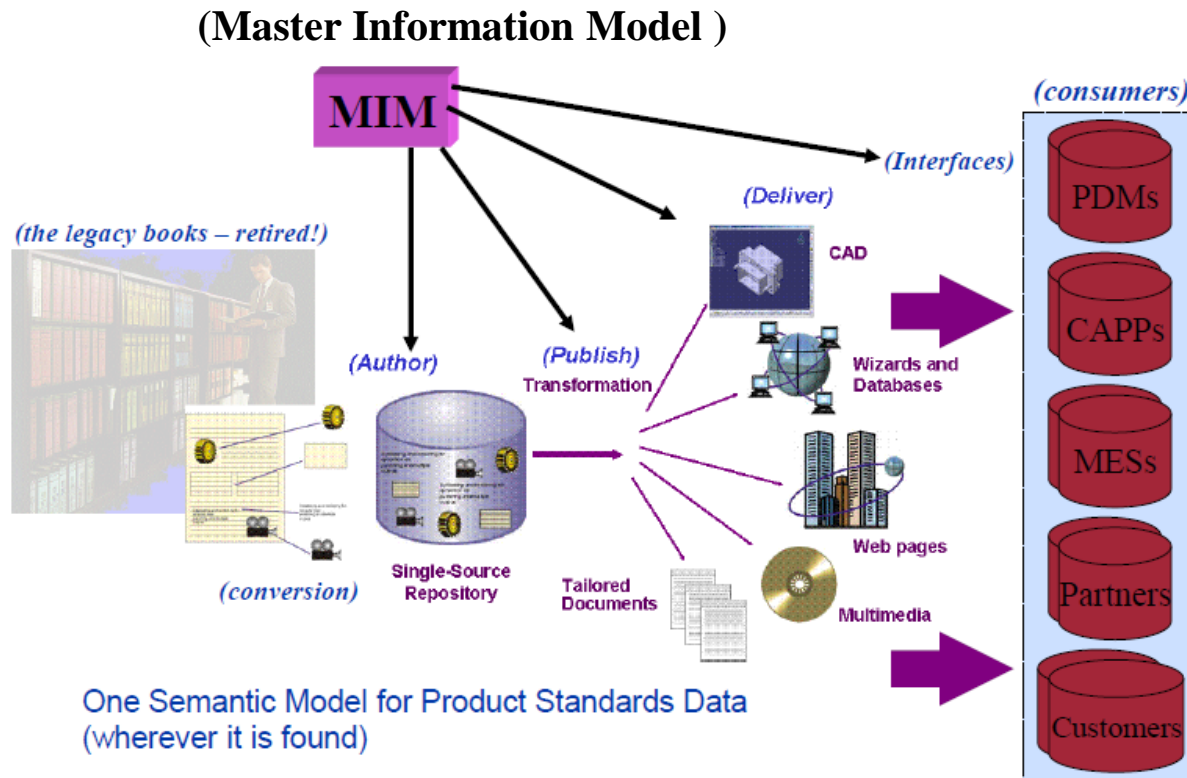
- 2001, ISO/IEC released the international standard in the form of database for the first time.
- 2005, AIA pointed out: Standards move to being managed and controlled as a collection of data elements, rather than as a paper paradigm document, so that users (human, machine, and other applications) can construct the appropriate “view” of the standards data that best meets their needs.
- 2011, ISO improved its publishing system and developed ISO STS (Standards Tag Suite) for standard publication.
- 2014, BSI proposed the following development trends of future standards: the way how standards are consumed will change-“Smart Standards”
- 2016, DIN pointed out: For supporting the digital transformation of our customers. Therefore, we engage in initiatives that define and implement future structures and formats of machine executable standards.





2. SITUATION ANALYSIS

Boeing has established a PSDD (Product Standard as Digital Data) system. By analyzing and cutting standards, extracting useful information that meets the needs of users and is delivered to users in an appropriate format (such as PDF, CAD model)



SOURCE: Strategic View-Delivering Product Standards Data in Multiple Forms to Multiple Platforms from a Single Source of Data

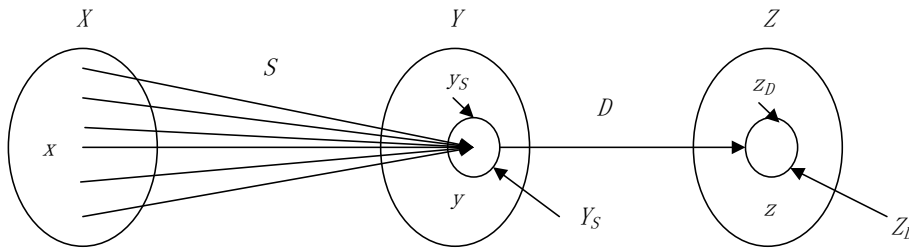


3. SPECIAL DIGITAL STANDARD MODEL

The special digital standard mainly solves the digitization problem of the standard itself. Its primary objective is to develop, publish and use the standard itself under the condition of digitization, which feature mainly includes:

- Develop standards in structured form;
- Publish standard form on demand;
- Realize the interconnection of standards and standard content;
- Realize full-text retrieval;
- Extract chapters, sections information from standard on demand;
- Standard can be executed by computer.

- For structured standard elements, they can be published in WORD, PDF, HTML, interactive manuals or in the form required by users.
- Standard elements for digitization can be published as databases, software, templates or content required by users.



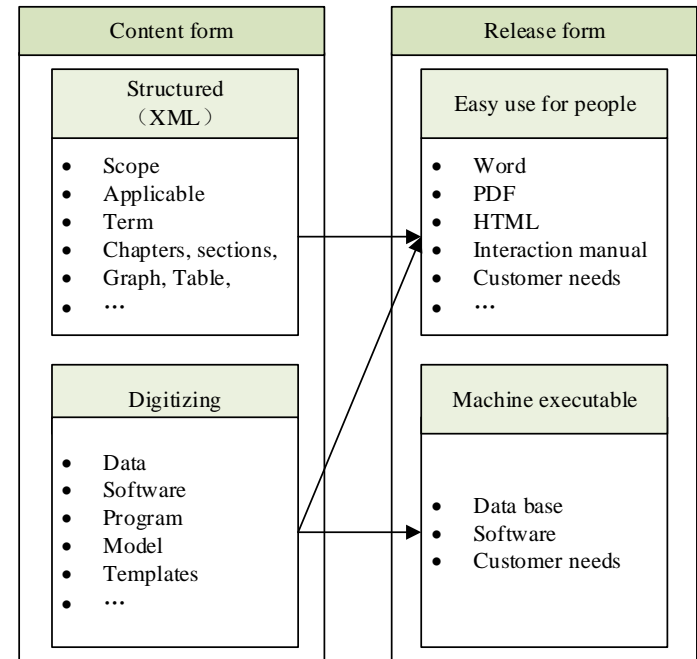
$$S : X \rightarrow Y_S$$

$$x \mapsto y_S = S(x)$$

$$D \circ S : X \rightarrow Z_D$$

$$x \mapsto Z_D = D(y_S) = D(S(x))$$

Special digital standard mathematical model

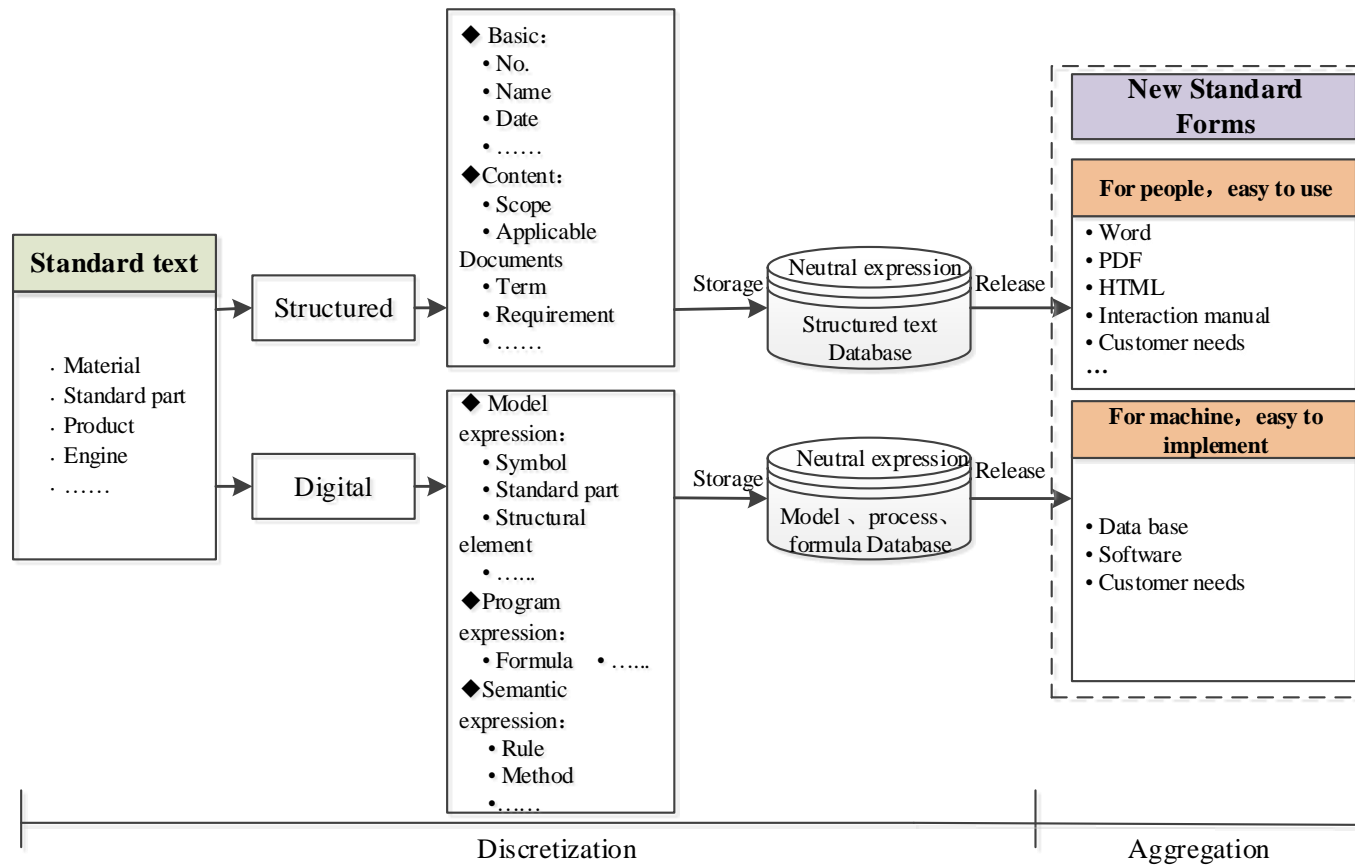


Special digital standard interpretive model



3. SPECIAL DIGITAL STANDARD MODEL

- In the process of forming special digital standard model, it is necessary to use the method of special discretization and aggregation.
- Discretization refers to the process of structuring the content of the standard structure and digitizing the content of the standard attribute.
- Aggregation is the process of forming discrete elements into a standard.



Formation process of special digital standard



4. GENERAL DIGITAL STANDARD MODEL

- Special digital standard is the digitization of standard itself, while general digital standard refers to how standard is applied to the process of digital development and production.
- In the process of digital development and production, standard is applied in a set instead of by itself. The formation of standard set is based on the process of digital development and production, and the process of aggregating standard elements.
- Standards are published one by one, while they are applied in the form of standard set.

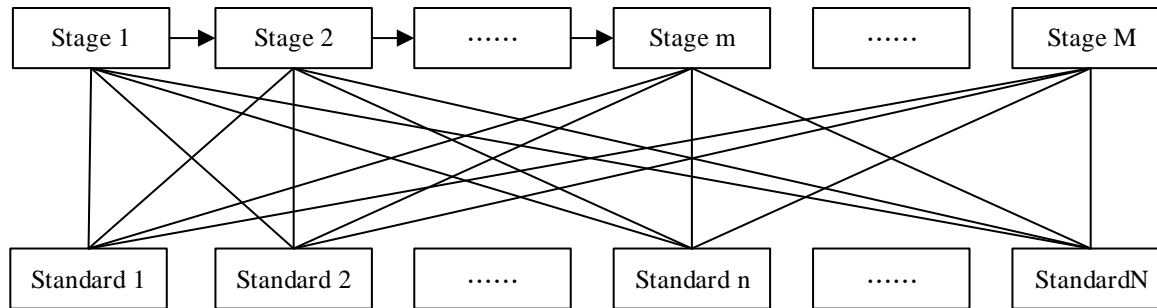


Figure 3 The example of standard set



4. GENERAL DIGITAL STANDARD MODEL

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- Under the current digital condition, the technical elements of aviation industry standards are decentralized, there is no unified model and process framework for application-oriented integration standards and standard elements, there is no relationship between standards and standard elements, the standard cannot be used integrated and customized during the process of digital development and production of aviation products.
- The form of general digital standard: **Manual + Software**
- The formation method of manual: **Discretization and aggregation**

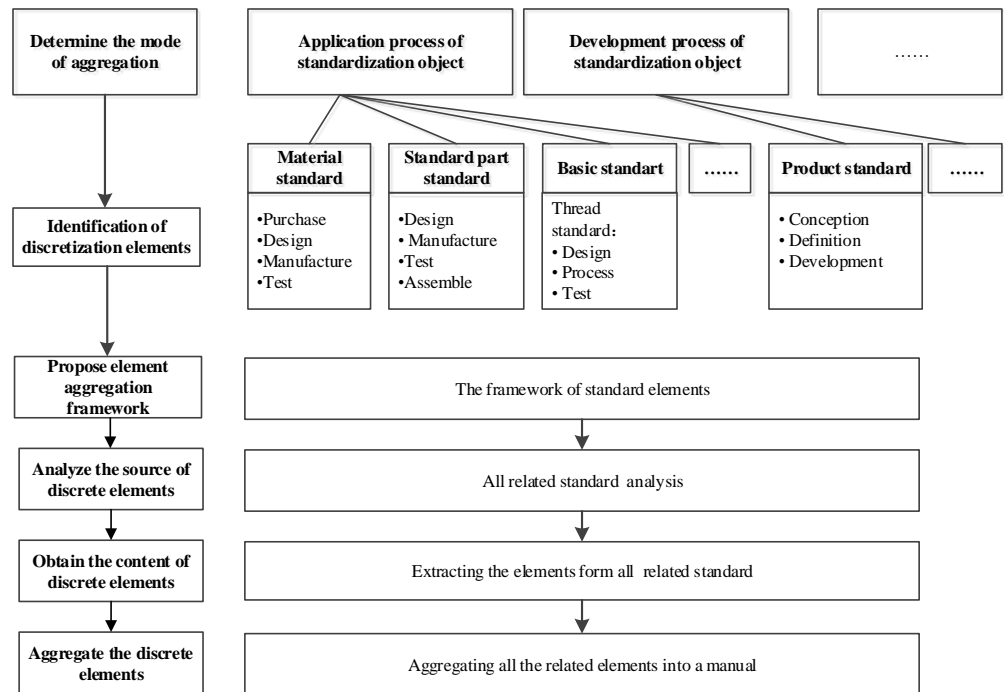


4. GENERAL DIGITAL STANDARD MODEL

Discretization and aggregation method of general standard is proposed, when the standard elements form general standard based on the process.

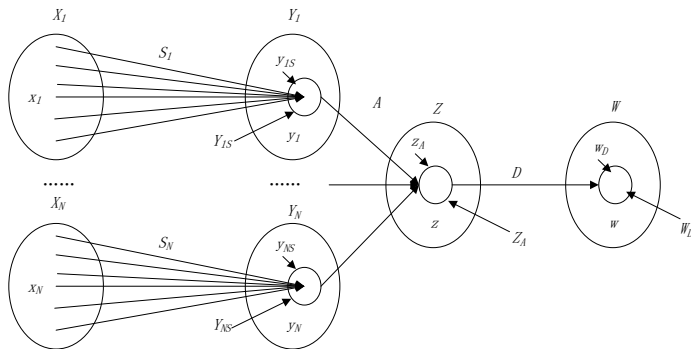
Discretization and aggregation process includes four steps:

- Determine the mode of aggregation
- Identification of discretization elements
- Propose element aggregation framework
- Analyze the source of discrete elements, obtain the content of discrete elements and aggregate the discrete elements



Discretization and aggregation process of general standard

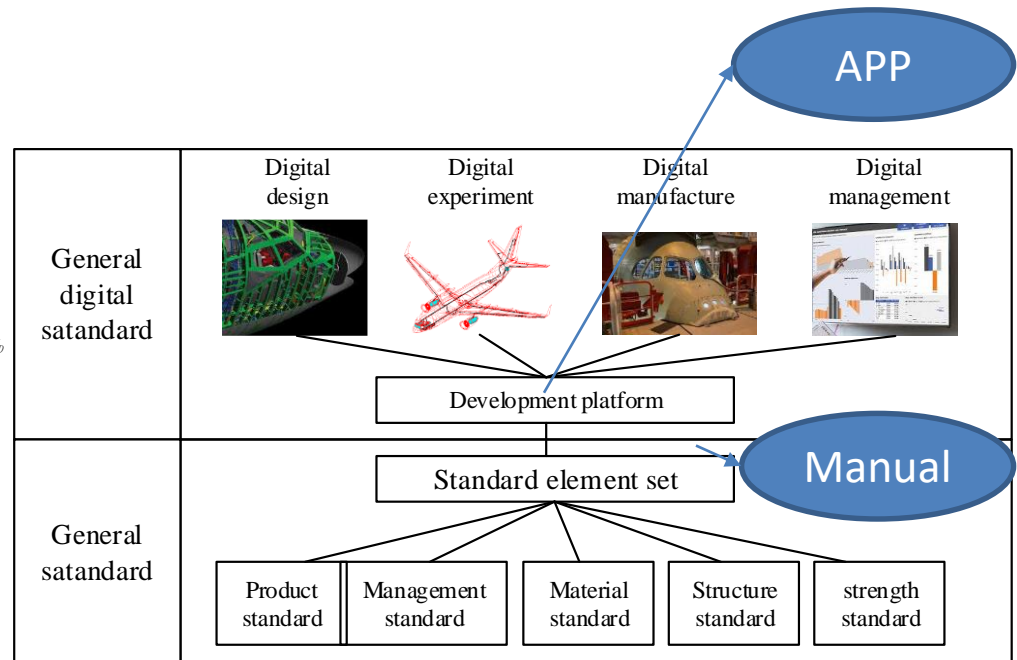
General standard is not a digital standard. Software or its supporting software should be developed to achieve digital design, test, manufacturing, management of aircraft, realizing software as standard.



$$x \mapsto z_A = A(y_{sn}) = A(S(x_n))$$

$$x \mapsto w_D = D(z_A) = D(A(S(x_n)))$$

General digital standard mathematical model



General digital standard interpretive model



5. CONCLUSION

- From standard itself perspective, in order to adapt to the digital environment, this paper puts forward a special digital standard model, which can provide a reference for the aviation standardization institutions to organize research, formulation and release of digital standard, so as to improve the efficiency and application effect of the standard development.
- From the application of standards in aviation industry perspective, there is a correlation between standards and standard elements, and multiple standards are used in the development process or activities of aviation products. Therefore, this paper puts forward a general digital standard model to solve the problem of how to form a standard set base on the product, and how to integrate standard set with the digital development software platform of aviation products.

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