Similarity of properties and similarity criteria

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The similarity of the properties of substances manifested in the one-parameter law of the corresponding states. The most known parameters are the critical compressibility factor Z_c and the Pitzer acentric factor. The subject of our analysis is two forms of the similarity criterion A by L P Filippov. The form chosen at the thermodynamic level is clearly related to the van der Waals equation of state (EOS). This makes it possible to connect the results obtained by us for a new one-parameter family of EOS, including many van der Waals type EOS. At the molecular level, the A capabilities appear after deciphering its connection with the shell molecule fundamental characteristic—its "rigidity". It calculates as a function of the atoms number in the molecule and the atomic shells overlapping degree. By determining the nature of the interaction, rigidity creates the intermolecular curves features into the singular points form. These features are projected into the thermodynamic surface features, including the critical parameters. In the empirically found expression, which relates the critical volume to the molecule size, L P Filippov "groped" for another fundamental point. The point fixes the inflection of the intermolecular force curve, which manifests in the Guldberg ratio. It concludes that it is precisely the "rigidity" that reflects the nuclear-electronic structure of a real molecule and ensures the similarity of interactions and properties. The work dedicates to the 95^{th} anniversary of L P Filippov.