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A Symmetric Variant of the Euler Conditions by Utilizing Summed Up Bernoulli Technique

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Introduction

The Euler conditions are a set of necessary conditions for a function to be an extremum of a given functional. They are widely used in calculus of variations and optimization theory. The Euler conditions can be derived by applying the calculus of variations to the functional under consideration. However, the standard Euler conditions are not symmetric under certain transformations, which may limit their applicability in some scenarios. A legend says that when Sovereign Dido escaped from her sibling Pygmalion along the North African coast, she showed up at the site that Tunisia presently involves. She asked Jarbas for a place to live and asylum there; He suggested that she keep a portion of the land where she could hide with an ox hide; As a result, she cut the skin into strips and joined them at the ends so that she planned for the largest area while keeping the strips' perimeter constant. It is alleged that she discovered the correct response, a circumference, in some way [1].

Description

To address this limitation, a symmetric variant of the Euler conditions can be derived by utilizing the Summed up Bernoulli technique. The Summed up Bernoulli technique is a mathematical tool that allows for the construction of symmetric functionals and conditions by considering the summed up contributions from multiple terms. The objective of this work is to extend the uses of GBM for the instance of isoperimetric issues or more all to communicate the variational issues without cyclic factors concerning the proposed technique. Articles showed the handiness of GBM for the instance of integrals like where one of the factors x or y is missing. In particularexposed the method for getting both, precise and logical estimated answers for certain variational issues with moving limits however without falling back on Euler formalism [2]. Truly, from articles we concluded that GBM is a strategy that gives the differential condition to some given variational issues making utilize just of rudimentary separations and essential polynomial math and this work underlines this point, yet permits to compose Euler conditions and in a symmetric manner [3].

We note that the known Euler conditions are not symmetric on the grounds that they don't represent a similar numerical structure. In contrast to those situations and have an undeniable evenness, by which, they are quite easy to recall; as a matter of fact, obviously it doesn't make any difference in the event that the separation is concerning δx or regarding δy, the outcome is separated regard to x and afterward to this, it is deducted the halfway separation of f regard to x and y, separately; we note that this technique is methodical and includes just essential variable based math and rudimentary separations. The first of these was a two-step approach to the isoperimetric problem solution: The first one relied on the fact that the function does not contain x, which we used to obtain the Dido variational problem's differential equation. After that, we discovered one of the GBM versions of the Euler equations that have been proposed for this work [4]. The arrangements of and brought about a similar response, for example, it needed to happen, a periphery. The second example, on the other hand, dealt with the isoperimetric problem of determining the form of a flexible, non-extensible, homogeneous rope of length l suspended between two points A and B. To accomplish this, we used the constraint to reduce the rope's energy. This work demonstrated how to use GBM to directly write Euler equations with the goal of extremizing them using a methodical approach based on elementary calculus, as was reported in; Additionally, this work emphasized the method's practical significance. GBM made it possible for us to write variational differential equations in a systematic and straightforward manner with little effort for this purpose, even though we did not need to keep in mind the established Euler formalism. A legend says that when Sovereign Dido escaped from her sibling Pygmalion along the North African coast, she showed up at the site that Tunisia presently involves. She asked Jarbas for a place to live and asylum there; He suggested that she keep a portion of the land where she could hide with an ox hide; As a result, she cut the skin into strips and joined them at the ends so that she planned for the largest area while keeping the strips' perimeter constant. It is alleged that she discovered the correct response, a circumference, in some way [5].

Lastly, we solved the problem to determine that the extreme curves belong to the catenary family. The third contextual investigation comprised in tracking down the differential condition for an isoperimetric variational issue contrasting the Euler formalism and GBM. Albeit this variational issue doesn't depict a known case, this model showed that the getting of the differential condition by utilizing GBM is simpler and direct in correlation with Euler formalism; also, the arrangement of known Euler tasks is long and includes both unwieldy separations and mathematical advances; while GBM steps required elementary differential calculus and algebra; In a sequence, GBM frequently solves the differential equation with the naked eye, which is crucial from a practical standpoint.

This article obtained a symmetrical version for the known Euler equations and the significance of this generalization of the proposed method lies not only in the fact that the proposed equations are easier to remember; In addition, this work demonstrated theoretically that the method that produced our symmetrical version and the corresponding variational method that permits the derivation of the classical Euler equations are equivalent; Consequently, both mathematical approaches are equivalent, at least in the case of integral-based variational problems.

Conclusion

This work presented a promising application of GBM to isoperimetric issues in order to move forward with GBM applications. As future work, we propose to expand the utilization of GBM for the instance of functionals depending of a few ward factors and one free factor, as well with respect to the instance of functionals relying upon twofold integrals.

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Conflict of Interest

No conflict of interest.

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