A topological structure on mechanical

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Abstract: In this paper, The concept of topological structure on Mechanical is introduced and some properties are studied.

Key Words: Fuzzy Set, Topological Structure, Mechanical and Fuzzy Topology.

INTRODUCTION
In sociology, economics, environment engineering, etc., the classical method does not give the exact value to solve some kind of problems given, where these kind of problems have their own uncertainties. Hence the need of fuzzy arises, fuzzy sets are used to calculate the uncertainties in a problem. In 1965, the researcher, L.A Zadeh was firstly proposed by fuzzy set theory to solve this situations. These fuzzy set theory has been studied for both mathematician and computer scientists and many applications on several areas of research such as machine learning energy producing like in mechanical area, aeronautical area, etc., we are discussed above the topological space, fuzzy topological space and thermal energy. We have solve some problems to fuzzy modes of transfer.

1. PRELIMINARIES

1.1 Definition
Let \( /g_1 \neq \emptyset \), a topological on \( X \), is a collection of “Open Subsets” of \( X \), which satisfy the following
1. \( X, \emptyset \) are open,
2. the union of any family of open set is open,
3. the finite intersection of any collection of open set is open.
\( \tau = \{ \text{all open subset of } X \} \), Topological space pair defined by \( (X, \tau) \)

1.2 Example \( X = \{a, b, c\} \) and \( \{\emptyset, \{a\}, \{a, b\}, X\} \)
1. \( \emptyset, X \) both are open,
2. Union of any two open set is open,
3. \( \{a\} \cap \{a, b\} = \{a\} \in \tau \)
1.3 Example

Let \( X = \{a, b, c\} \) be a set and let \( A = \{(a, 0.2), (b, 0.5), (c, 1)\}, B = \{(a, 0.5), (b, 0.2), (c, 1)\} \) be a two open subset.

1. \( X, A, B \) are open,
2. \( A \cup B = \{(a, 0.2), (b, 0.5), (c, 1)\} \cup \{(a, 0.5), (b, 0.2), (c, 1)\} \)
   \( A \cup B = \{(a, 0.5), (b, 0.5), (c, 1)\} \)
   \( \therefore \) The union of two open subset is open.
3. \( A \cap B = \{(a, 0.2), (b, 0.5), (c, 1)\} \cap \{(a, 0.5), (b, 0.2), (c, 1)\} \)
   \( A \cap B = \{(a, 0.2), (b, 0.2), (c, 1)\} \)
   \( \therefore \) The intersection of two open set is open.

1.3 Definition

Let \((X, \tau_1) and (X_2, \tau_2)\) be a topological space when \( X = X_1, X_2, \cdots X_n \)
Such that \( p_i: (X_1, X_2, \cdots X_n) \rightarrow X_i \) which is continuous function, hence the inverse image of \( P_i \) is also continuous.

2. FUZZY TOPOLOGICAL SPACES

2.1 Definition:
A family \( \delta \subseteq I^X \) of fuzzy set is known as the Fuzzy topology of \( X \), if it satisfies the following axioms
1. \( \forall \alpha \in I, \alpha \in \delta \forall A \),
2. \( B \in \delta \Rightarrow A \cap B \in \delta \).
3. \( \forall (A_j)_{|j} \in \delta \Rightarrow \cup_{|j} A \in \delta \).

Remark: The pair \((X, \delta)\) is known as a fuzzy topological space, or a functions, the elements \( \delta \) are known as a fuzzy open sets.

2.2 Definition
Let \((x, \delta) and (Y, \sigma)\) be a fuzzy topological spaces. The fuzzy space of a product of \( X \) and \( Y \) are a Cartesian product \( X \times Y \) of sets \( X \) and \( Y \) together within the fuzzy topology is generated as by a family \( \{(P_1^{-1}(A_j), P_2^{-1}(B_k)) : A_j \in \delta, B_k \in \sigma, \text{ where } P_1 \text{ and } P_2 \text{ are projections of } \}
\( X \times Y \) onto \( X \) and \( Y \) respectively\), because \( P_1^{-1}(A_j) = A_j \times 1, P_2^{-1}(B_k) = 1 \times B_k \) and \( (A_j \times 1) \lor (1 \times B_k) = A_j \times B_k \), the family \( \{A_j \times A_j \in \delta, B_k \in \sigma\} \) forms a base for the fuzzy product topology \( X \times Y \).

3. THERMAL ENERGY

3.1 Definition
Thermal energy used the inner energy of any object by reasoning of the kinetic energy of its Molecules and/or Atoms. The Molecules /Atoms of a temperatured object had large number of kinetic energy, then those of a low temperature are in the form of Translational motion, Rotational, or the cases like gas, Vibrational.
Example of both Thermal and Kinetic energy

1. When due to a rise in temperature of a molecules and atoms are vibrating higher comes from a substance is also known as thermal energy
2. Heat energy is also named as Thermal energy.
3. Kinetic energy is an energy of a Moving object.

Flow chart of Power Plant on Thermal:

3.1 Modes of Heat Transfer
1. Conduction
2. Convention
3. Radiation

3.1.1 Conduction
Conduction is an energy transfer from the greater energetic particle to lower energetic particle due to the interaction between the particle.

Fourier's law of heat conduction

\[ Q = -kA \left( \frac{dt}{dx} \right) \]

K – Conductivity of thermal
A - Area

\[ \frac{dt}{dx} \] - Temperature gradient depends on distance
3.1.2 Convention
Convention is an energy transfer between a surface of solid and the motions are in liquid or gas, it is the conduction fluid motion of combined effects.

**Newton’s law of cooling**
\[ Q = hA_s(T_s - T_\infty) \]
- \( Q \) - Heat transfer co-efficient of convective
- \( T_s \) - Surface of the temperature.
- \( T_\infty \) - Temperature outer from the surface
- \( A_s \) - Area of surface

3.1.3 Radiation
1. All matter can emit, absorb, transmit the radiation above the Absolute zero.
2. Radiation is the fastest phenomenon of heat transfer.

**Stefen - Boltzman law**
\[ Q_{emit,max} = \sigma A_s T_s^4 \]
- \( \sigma \) - 5.67x10^8 W/m^2K^4
- \( A_s \) - Area of surface
- \( T \) - Temperature of the surface.

4. Fuzzy topological in thermal energy

4.1 Definition of Fuzzy thermal energy
Thermal energy of Fuzzy Topology (TFT) is the inner energy of a fuzzy object by reasoning of its kinetic energy of an atoms/molecules. The molecules/atoms of a Fuzzy area having a greatest energy in the form of a vibration, rotational, in the case of gas, transitional motion, etc.

4.1 Conduction
The Conduction of Fuzzy Topology (CFT) is an energy transfer from the Higher energy FT particle (HFT) to Lower energy FT particle (LFT) due to the interaction between the fuzzy particle.

Fuzzy Fourier’s law of heat conduction
\[ \delta = -K\sigma \left( \frac{\theta_0 - \theta_1}{\alpha} \right) \]

4.1.1 Problem
In an outer fuzzy topological surface of a 0.2m thick concrete wall is kept at an initial fuzzy temperature of 0.51°C, while the inner fuzzy surface is kept 0.7°C, in the thermal fuzzy conductivity of concrete 0.92W/(mk).

Determine the FT Heat loss through a wall 0.6m long and 0.7m high.

**Solution:**
- \( K \) - 0.92 w/(mk)
- \( \theta_1 \) - 0.7°C
- \( \theta_0 \) - 0.51°C
- \( \delta \) -?
In fuzzy expression on Fourier’s law of conductivity,
\[
\delta = -K\sigma \left( \frac{\theta_0 - \theta_1}{\alpha} \right)
\]
\[
= (-0.92)(0.6 \times 0.7)\left( \frac{0.51-0.7}{0.2} \right)
\]
\[
\delta = 0.36
\]
The Fuzzy fourier’s law of heat conduction is 0.36.

4.2 Convention
The convention of fuzzy topology is an energy transfer between a Surface of a Solid in Fuzzy Topology(SFT) to the Liquid surface Fuzzy Topology(LFT) or Gas Fuzzy Topology(GFT) that is in amotion in a topological, it is the conduction fluid motion of combined effects.

\[
\delta = \theta_0 + \sigma e^{-ht}
\]

Problem 4.2.1
An object is heated to 0.7°F and to cool in a room, whose air temperature away on the surface is 0.2°F, after 0.10 min the temperature on fuzzy area is 0.3°F. What is the temperature after 0.2 min.

Solution:
\[
\theta_0 = 0.2°F \quad \theta_1 = 0.3°F
\]
\[
\theta_1 = 0.7°F
\]
\[
\delta = \theta_0 + \sigma e^{-ht} \quad (1)
\]
\[
t=0, \quad \theta_1 = 0.7
\]

Step 1:
In initial time, \( t = 0 \), \( \theta_1 = 0.7 \) in eqn(1)
\[
0.7 = 0.2 + \sigma e^{-h(0)}
\]
\[
0.5 = \sigma e^{0}
\]
\[
\sigma = 0.5
\]

Step 2:
\[
t = 0.1, \quad \theta_1 = 0.3, \quad \theta_0 = 0.2, \quad \sigma = 0.5 \quad \text{sub in (1)}
\]
\[
0.3 = 0.2 + (0.5)e^{-h(0.1)}
\]
\[
0.1 = 0.5e^{-0.1h}
\]
\[
0.1 = e^{-0.1h}
\]
\[
-0.1h = \log\left( \frac{0.1}{0.5} \right)
\]
\[
h = -\frac{1}{0.1} \log\left( \frac{0.1}{0.5} \right)
\]
\[
\text{sub } h = -\delta = \theta_0 + \sigma e^{-ht}, \quad \sigma = 0.5 \text{ in (1)}
\]
\[
\delta = 0.2 + (0.5)e^{-\frac{1}{0.1}\log\left( \frac{0.1}{0.5} \right)(0.2)}
\]
\[
= 0.2 + 0.5\left( e^{\log\left( \frac{0.1}{0.5} \right)^2} \right)
\]
\[
= 0.2 + 0.5\left( \frac{0.1^2}{0.5^2} \right)
\]
\[
= 0.2 + 0.5(0.04)
\]
\[
\delta = 0.22
\]
Radiation 4.3
In a fuzzy topological space, there is no medium between all matters can emit absorb, transmit the radiation above the absolute zero.

\[ \delta_{(\text{emit, max})} = \sigma \theta_s T_s^4 \]

Problem 4.3.1
When the power would it produce if operated at a temperature of only 500 Kelvin.

Solution:
\[
\begin{align*}
T_s &= \frac{T_{\text{hot}}}{T_{\text{cold}}} \\
\theta_s &= \frac{\theta_{\text{hot}}}{\theta_{\text{cold}}} \\
\delta \Rightarrow \frac{\theta_{\text{hot}}}{\theta_{\text{cold}}} &= \left( \frac{T_{\text{hot}}}{T_{\text{cold}}} \right)^4 \\
\frac{200}{\theta_c} &= \left( \frac{200}{500} \right)^4 \\
\frac{200}{\theta_c} &= (4)^4 \\
\frac{200}{256} &= \theta_c \\
\theta_c &= 500 \\
\theta_c &= 0.78 \text{ watts}
\end{align*}
\]

Conclusion: In this paper we discussed topological space, fuzzy topological space and thermal energy, we execute this thermal energy explained in fuzzy topology and we solved some problems to fuzzy modes of transfer.

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