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## Extension of the Legendre-Fenchel transform

### Abstract

The Legendre-Fenchel transformation of a functional  $f$  on a space  $\Phi$  is a functional  $f^*$  on dual space  $\Phi^*$  given by

$$f^*(p) = \sup\{p(\varphi) - f(\varphi) : \varphi \in \Phi\}, \quad p \in \Phi^*.$$

Let  $K$  be a cone in  $\Phi$  such that  $f(\varphi) = +\infty$  for  $\varphi \in \Phi \setminus K$ , There exists a functional  $\tilde{f}_K^*$  naturally define on an extension  $\tilde{\Phi}_K^*$  of the space  $\Phi^*$ . The properties of  $\tilde{\Phi}_K^*$  and some applications will be given.